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THE CONDOR

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Issued March 15, 1938

CONTENTS

| | PAGE |
|--|---------------------------|
| Behavior of the Bush-tit in the Breeding Season (with four ill.)..... | Alice Baldwin Addicott 49 |
| Relations between Man and Birds in Western Europe (with three ill.)..... | Tracy I. Storer 63 |
| Observations on the Effect of a Spring Drought on Reproduction in the Hungarian Partridge..... | Paul L. Errington 71 |
| and F. N. Hamerstrom, Jr..... | |
| The Status of the Fox Sparrow of Southwestern Oregon (with two ill.)..... | John E. Cushing, Jr. 73 |
| Environmental Factors Affecting Waterfowl in the Suisun Area, California..... | James Moffitt 76 |
| FROM FIELD AND STUDY | |
| Behavior of Northern Phalaropes..... | Charles W. Michael 85 |
| Fire Ants Attacking California Quail Chicks..... | John T. Emlen, Jr. 85 |
| Creeper Nesting in Solano County, California (with one ill.)..... | Emerson A. Stoner 86 |
| The Timberline Sparrow in Arizona..... | James O. Stevenson 86 |
| Another Saw-whet Owl from the San Bernardino Mountains, California..... | G. Willett 87 |
| An Unusually Early Molt in the Ruddy Duck..... | Robert T. Orr 87 |
| An Incubating Male California Quail (with one ill.)..... | John B. Price 87 |
| Further Records from St. Lawrence Island, Alaska..... | Herbert Friedmann 88 |
| Notes from Buena Vista Lake, Kern County, California..... | J. Stuart Rowley 88 |
| Occurrence of the Marbled Godwit on the Coast of Oregon..... | J. C. Braly 88 |
| Two Gull Records for California..... | Allan Brooks 89 |
| A New Race of Horned Lark from the Region of Great Salt Lake..... | William H. Behle 89 |
| Midwinter Records from the Vicinity of San Diego, California..... | Lawrence M. Huey 90 |
| Laysan Albatross on San Nicolas Island, California..... | James L. Peters 90 |
| Screech Owls and Automobiles..... | Albert C. Hawbecker 90 |
| Red Phalarope on the Berkeley Campus, Alameda County, California..... | Joe T. Marshall, Jr. 91 |
| The Groove-billed Ani of Lower California and Northwestern Mexico..... | A. J. van Rossem 91 |
| Some Notes on Waterfowl in San Bernardino and Riverside Counties, California..... | Harold M. Hall 91 |
| Hybridization of Juncos in Captivity..... | Alden H. Miller 92 |
| Records of Arrival of Calliope Hummingbirds..... | Charles W. Michael 93 |
| NOTES AND NEWS..... | 94 |
| MINUTES OF COOPER CLUB MEETINGS..... | 95 |

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TS

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DE
49
33

71
73
76

35
35
36
36
37
37
37
38
38
38
39
39
40
40
40
41
41
41
42
43

94
95

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THE CONDOR

VOLUME XL

MARCH-APRIL, 1938

NUMBER 2

BEHAVIOR OF THE BUSH-TIT IN THE BREEDING SEASON

WITH FOUR ILLUSTRATIONS

By ALICE BALDWIN ADDICOTT

The Bush-tit (*Psaltiriparus minimus*) is a species which offers many problems for study and observation in connection with its flocking and nesting habits. The accounts of breeding behavior which are presented here are based chiefly on information obtained in 1932 and 1933 in Santa Clara County, California, and relate to the coastal race, *P. m. minimus*. Most of the observations were made on the Stanford University campus.

Beginning of the Mating Season.—As early as January and February flocks of bush-tits which have remained intact during the fall and winter start dividing into smaller and smaller groups. At the same time a few pairs may be found which have separated from the flocks and which have wandered off in search of nesting territory. In 1933 on the Stanford campus, two such pairs were found, one on January 4 and the second on January 11. A week of unusually warm weather may have accounted for the early mating; neither pair built a nest at that time. However, nests commonly are started in February, and the breeding season is at its height in March and April. After May 1 the number of nesting pairs diminishes as the season advances, but nests containing fresh eggs have been reported by Grinnell (Pasadena Acad. Sci., vol. 2, 1898, p. 50) and Willett (Pac. Coast Avif. No. 7, 1912, p. 105) as late as July.

At the beginning of the mating season, courtship may be observed in pairs which have separated from the flocks as well as within the small flocks which are existent during this part of the year. Courting consists chiefly of excited location notes, trills and sexual posturing.

A pair which has left the flock may wander away and forage separately for as long as a week before nest building is begun. In this period the birds appear at times to be seeking a nest site, for feeding is often replaced by rather aimless wandering through the territory. In the case of the January matings noted above, it is probable that the birds rejoined the flock.

The Nest Territory.—The size of the nest territory varies considerably, and it does not appear to be constant even for the same pair. It may vary from a diameter of fifty yards to one of three or four hundred yards, depending on the nature of the area and on the abundance of nesting materials and food.

Territorial ownership appears to be poorly developed. When a stray bird enters the territory of a nesting pair, the latter may respond by chasing the intruder for a few seconds, giving utterance to excited alarm notes and trills, until the intruder leaves. However, in many instances a stray bird is ignored, and it may even be allowed to forage with the mated pair. Toleration of stray birds may go even further than this. At the time of incubation, at one nest, three birds were found foraging together in the nest territory on two consecutive days for as long as an hour at a time. All three took an active part in nesting activities. While one bird covered the eggs within the nest, the other two foraged together, feeding and collecting nest material. When these two re-

turned, the one in the nest left immediately for another tree. One of the others entered the nest with nest material and then came out. The third bird then went into the nest and incubated the eggs for ten minutes while the second joined the first in foraging. The same toleration was noted at this same nest on the second day after the eggs hatched. In this instance three birds took turns feeding and brooding the young. The identity of the individuals was impossible to determine as none of the birds wore bands.

Such toleration suggests that the gregarious habits of the species carry over into the breeding season. It has been found in the study of the flocking habits of the bush-tit that the size of the flock territory is rather elastic. A flock remains within a general area, the limits of which, however, are not clearly defined. Flocks frequently enter the territory of other flocks, or part of any given flock may separate from the group and enter the territory of another for a time before returning. Frequently individuals from one group join an entirely new flock. This has been determined by observation of banded birds. It seems possible, then, that the sense of territory of a nesting pair may be modified by the characteristic tolerance and gregariousness of the species.

Construction of the Nest.—The nest built by the Coast Bush-tit is an intricate, pendant structure, hung in a concealing clump of leaves of an overhanging branch, and it is built of materials which blend with its surroundings, such as mosses, lichens, oak leaves and spider web. The entrance consists of a hole, usually placed on one side near the top, either above or below the supporting twigs. Above the entrance is the hood which is carefully woven around several twigs and which covers the top of the nest. Below the entrance is the neck which is the passage to the bowl, where the eggs are laid. The nest is entered horizontally, but the passage bends immediately and is vertical in the neck. At the bottom the passage flares to make the bowl. The neck is the slenderest, and usually the thinnest, part. The widest portion is the bowl, and here the walls are much thicker and are heavily lined. These features combined with the thick floor of the bowl, make the latter a warm place for the development of eggs and young. Nests average 23 cm. in length and the diameter of the entrance hole is between 2 and 3 cm. The widths of the nests and the thicknesses of the walls remain rather constant, but the total length, the internal length and the thickness of the floor of the bowl are variable. The distance of the entrance from the top of the hood depends on the type of entrance which is built.

The first step in the construction of any bush-tit nest is the building of the rim. This is a delicate circle of nest material bound together with spider web and supported between the forks of a twig or between two adjacent twigs to which it is firmly fastened (fig. 20A). This circular rim is almost always horizontal, or is nearly so, and in no case which has been observed does this hole ever remain as the final entrance of the nest. It is rather the rim of a preliminary open bag.

After the rim has been built, nest construction may proceed in either of two ways. In the first and most prevalent method, a small bag, perhaps an inch in depth, is hung from the rim (fig. 20B), loosely woven and very thin and delicate. In building, the birds cling to the edge of the rim and hang head down into the bag, adding materials to strengthen and thicken it. After this first tiny sac has been made strong it is stretched and extended from within, and then the thin places which result are filled in with more nest material. As the nest becomes longer, the birds enter it head first to carry on the work. After a bird disappears inside, the nest shakes violently and bulges out in place after place as the new material is added in the thin sections. The shaking apparently serves to stretch the structure. Most of the work is done from the inside, but some of the thick parts of the bowl are added to from the outside, the birds clinging to the sides as they work. The nest is now a long pendant bag, open at the top (fig. 20C).

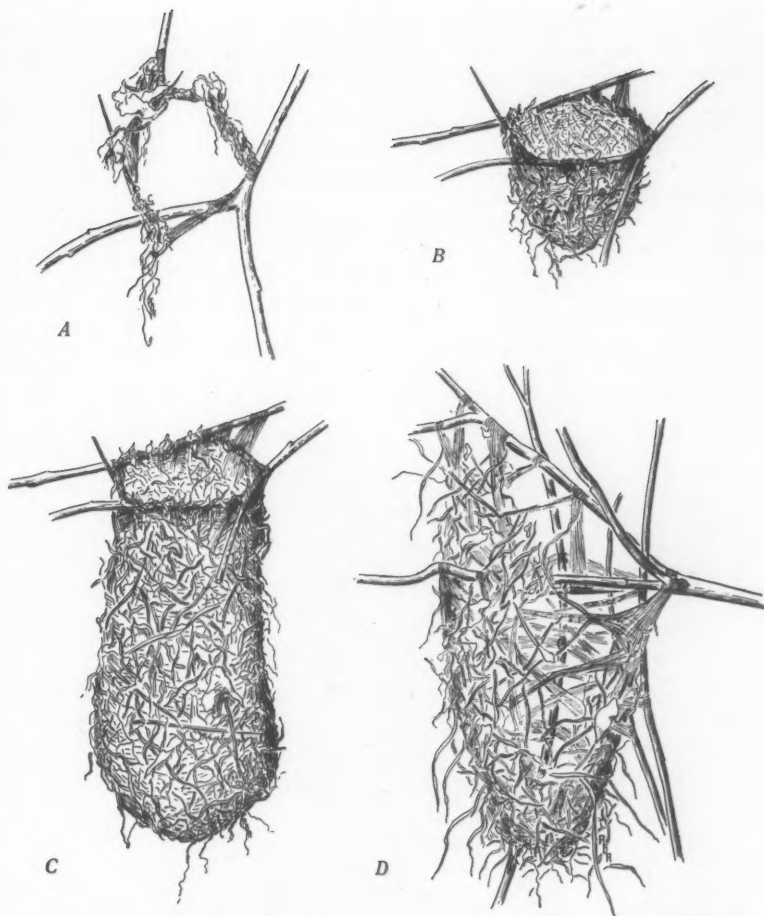


Fig. 20. Stages in the construction of bush-tit nests. *A*, the initial rim; *B*, small loosely woven bag hung from the rim; *C*, partly constructed nest before hood is built; *D*, a second-day nest showing loose type of construction.

When the hood and final entrance of the nest are built, material is added to the back and sides of the original rim. Material is brought over the top until the original hole has been roofed over and the entrance thus shifted to one side of the top (fig. 21). Rarely one finds a nest with the entrance hole only partly roofed over.

As the nest nears completion, a lining of spider web, down, or feathers is made for the passageway and the bowl. The bowl is thickened and filled in, and the walls above the floor of the nest for at least an inch are made quite thick. Material is added to the nest from time to time until the eggs have hatched, probably because the nest, being pendant, needs continual repairing.

In the second method, on the day following the building of a circular rim, a long extremely loose bag is constructed of strands of material hung from the rim (fig. 20*D*). Second-day nests as long as five inches have been observed, and Merriam (*Auk*, vol. 13, 1896, p. 123) reports one eight inches long. This long loose bag is strengthened with building materials added both from the outside and the inside, the thin places being filled in as before. Nests built toward the end of the season, or second nests, are usually constructed in this manner. They are built much more quickly, but are not as strong as those which are built more slowly.

The location of the entrance of the nest in relation to the supporting twigs varies. In some, the hood and entrance are built above the support (fig. 21). In such instances the nest is built as already described. In others, the top of the hood is fastened to the twigs and the entrance is below the support (fig. 22). In a structure of this latter kind, the original rim or hole between the supporting twigs is closed up when the nest is almost complete and a new entrance is made in the neck below. One nest that was observed illustrates this nicely. On the day that the first egg was laid the nest was fourteen inches long with a three-inch bowl and a long slender neck. The nest was entered



Fig. 21. Bush-tit nest with hooded entrance above supporting twigs.

by a hole at the extreme top between the forks of a supporting twig, and there was no hood. On the following day the birds opened a new hole a third of the distance down from the top and used this as an entrance, although the first entrance still remained. Occasionally one of the pair darted into the first hole, and then backed out as the passage just above the lower hole was blocked. Later the upper part was filled in solidly.

The construction of the nest is sometimes especially adapted to the immediate surroundings. One nest which was begun in the normal manner was bent to one side when a small branch directly below the three-inch bag prevented further extension directly downward. Another interesting nest was found, which, contrary to normal conditions, was not pendant, but lay almost horizontally on a thick tangle of branches. The bowl was slightly lower than the hood, and the nest was entered by a hole on the upper side of the hood, corresponding to the position in pendant structures.

Both members of the pair appear to share equally in the construction of the nest. They commonly search for materials together and return to the nest at about the same time. A careful study of the details of construction is instructive. The following account of the activities of a pair of mated birds is typical of the first stages of nest building:

The nest had just been started when found and consisted of a flimsy circle of spider webs and plant materials. The rim was supported in the angle of a forked twig and was attached by strands of spider web.

11:05. Both birds returned to the nest together, carrying nest material. One stood quietly on a twig while the other worked. When the first had finished, the second hopped onto the rim, thrusting its head through the opening. After fastening the material into the side of the nest, it moved its head rapidly up and down as though "sewing." Both left the nest and were gone fifty-five minutes.

12:00. One returned alone. It perched on a twig close to the nest and held the spider web which it had brought against the limb with its foot. Then, catching small bits of it in the bill, it pulled the web out into strands which it fastened to a near-by branch. The bird then darted to a large limb of the oak and, clinging vertically to the bark, removed a lichen. This was then poked in among the strands of the web.

12:10. The mate returned and added a little material to the rim, and both birds left together.

12:15. Both returned together. One hopped into the circle, fluttered its wings and poked at the sides of the rim. It appeared to be trying to keep the opening clear and large enough for entrance.

12:20. Both returned together. One bird took a strand of spider web and bound one end into the top of the rim, carried it up over a twig and fastened it into the nest again. Then it hopped into the circle and enlarged it with a flutter of the wings.

12:40. One of the pair brought a white mass of spider web to the nest. This it attached to the twig above the nest by holding it on the limb with its foot. With the bill it pulled out strands of the web and stretched them down to the nest; it "sewed" them in, and spun them back and forth over the upper twig several times.

It is noteworthy that the bush-tit nest should be started, as are those of other passerine birds which build pendant nests open at the top, by the construction of the rim. This suggests that the steps in nest building recapitulate the evolution of the nest building instincts.

Materials Used in Nest Building.—Bush-tit nests are built of materials found commonly in the breeding territory. Lichens, mosses, grasses and the staminate flowers of the live oak, *Quercus agrifolia*, are constituents of almost all nests. These are woven together with hundreds of strands of spider web. Other materials found less commonly are filaree fruits, bark fibers, various plant downs, fir or spruce needles, oak leaves, acacia blossoms, blossoms of other plants such as broom and the pappi of composite flowers, feathers, bits of paper and string, and insect cocoons. The material found in any nest is largely dependent on its surroundings. Thus, those built along creek bottoms contain willow and cottonwood down, those hung in fir trees have many needles, and those built near human habitations almost invariably contain some string or paper, which, although appearing decorative to the human observer, are probably used simply because they are abundant.

Since the largest number of nests hangs in live oaks, it is not strange that the most abundant materials should be from this tree itself or from plants on or near it. In nests which are started or are in the process of construction at the time when the staminate

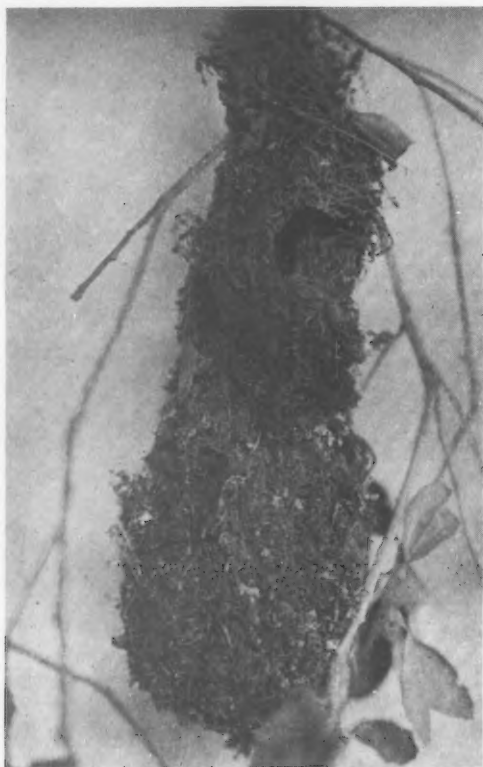


Fig. 22. Nest with entrance below supporting twigs.

flowers of the oak are in blossom, large numbers of these structures are found, the whole inflorescence being used. They are woven into all parts of the nest, but are especially common on the outside, where they serve to make the nest blend with its surroundings. There is no reason to believe that this protective camouflage is purposeful. The bark of the live oak and the branches of black oaks, toyon and other plants are covered with various lichens and mosses. These are found in all nests and throughout the entire structure, giving the nest strength and body as well as an inconspicuous neutral color. Many grasses also are used.

Feathers are woven into the body of the nest whenever available, as many as three hundred having been found in one nest. Frequently they line the bowl, but in nests in which no feathers are found, the bowl is lined with spider web or plant down.

By far the most essential material in bush-tit nests is spider web; it is found in every nest and throughout all parts of it. In 1932, two birds were observed in an *Araucaria imbricata* tree, north of the Stanford Mausoleum, as they collected huge bill loads of the spider webs which were stretched between the sharp scale-like leaves. On one occasion a pair of bush-tits discovered a low dead bush near their nest. One branch in particular was covered with a thick mat of webs and the birds returned to it frequently. Grasping a part of the mat in the bill, they would back off from it, fluttering and hopping, and pulling with the head. Often they both worked on the same section of web, pulling in opposite directions. Each carried a portion of it to the nest and returned for more. The web is an excellent binding material, being more or less adhesive, and it is easily pulled out into long strands. The entire success of the nest is dependent on the strength of the web.

The parts of the nest differ in the proportions of various materials used. In the neck the proportion of webs is high, since this part must carry the weight of the nest, and that of grasses and plant down and feathers is low. Large quantities of lichen, moss and oak blossoms are woven into the meshwork of spider webs in the neck. The bowl and hood have a large proportion of grasses and a smaller amount of web. The lichens and mosses are present here also. The web is apparently not as essential in these parts, as the materials tend to bind themselves together. Often the floor of the bowl is several inches thick and quite solid. It has been suggested (Dunn, Warbler, vol. 2, 1906, p. 29) that the thickness of the bowl is correlated with the amount of wind which blows in the region, but it seems more likely that it is related to the time spent in building. Second nests, and those built late in the season, are constructed quickly and the bowl is not thick.

Time Devoted to Nest Building.—The time required for the completion of a nest varies to a considerable extent. As a standard of measurement, the number of days between the beginning of nest building and the laying of the first egg was adopted. Building is rarely stopped in the course of this period and is usually continued after egg-laying. The shortest time recorded is 13 days, and the longest is 51. The following table presents the dates on which various nests were started and completed and the number of days occupied in construction:

| Nest | Date started | Date completed | Number of days |
|------------|--------------|----------------|----------------|
| 1932 1 | February 13 | April 13 | 51 |
| (San Jose) | February 2 | March 26 | 49 |
| 9 | February 12 | March 26 | 42 |
| 1933 2 | February 27 | April 6 | 38 |
| 11 | February 28 | April 3 | 34 |
| 10 | March 12 | April 3 | 25 |
| 9 | March 24 | April 7 | 14 |
| 13 | April 9 | April 22 | 13 |
| | | | Average 33.2 |

Nest 1 (1932), which took the birds 51 days to build, was not worked on for seven days in the course of the building period. This has already been subtracted from the total. Severe cold weather occurred three days after construction had started and during this time no work was done. It will be noted that this is an early date.

Nest 2 was disturbed on two occasions while it was being built. The birds were removed from the nest at night and one of the pair was banded. In both cases the banded bird deserted. Building was continued with a new mate within one day and the total number of days was but 38. Number 9 was a second nest built after the desertion of the first due to banding. Only 15 days were used. Nest 10 was the third started by the same pair of birds. Each of the first two nests progressed as far as the rim stage and was

then abandoned. The third was rather loosely built, and the eggs were laid 25 days after the nest was started. No. 13, which was completed in 13 days, is interesting from two standpoints. First, it was started a month later than any of the others. Second, it was begun as a long loose bag as described previously. On the first day, the rim was constructed, and on the second the loose five-inch bag had been completed. The finished nest was not as strongly built as those which took longer to build.

The graph (fig. 23) shows the difference in the length of time taken to build nests in February, March and April, combining the years 1932 and 1933. Whether the decrease was due to the advance in the season or to increasing amounts of nest material is

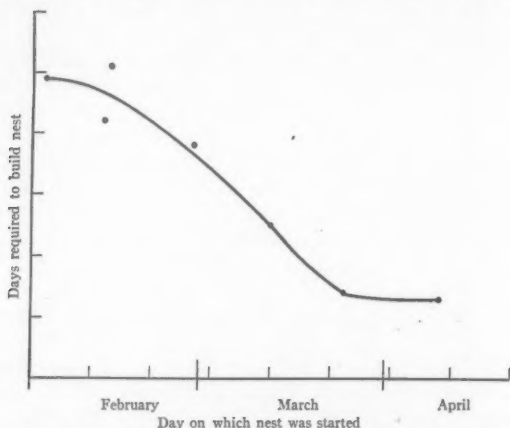


Fig. 23. Graph showing diminution in time required to build nest with advance of the season.

not known. Most of the later nests are second nests, and it has been found that these are built more quickly. This may therefore be an important factor influencing the curve.

Second Nests.—One sees frequent references in the literature to bush-tits which have rebuilt after the first nest has been disturbed (Merriam, Auk, vol. 13, 1896, p. 123 and Osgood, Oologist, vol. 9, 1892, p. 227). Out of 15 nests under observation on the Stanford campus in 1933, 10 were deserted, and of these, second nests were located for 6 of the pairs concerned and the collection of nest materials was noted in the remaining cases. In one instance the birds deserted when the nest was half built. Two of the pairs which rebuilt had completed the first set of eggs. One pair had laid but two eggs. Osgood (*loc. cit.*) reports having twice taken a full set of eggs from one pair. New nests were built in both instances.

The material of the first nest is frequently utilized in building the second. The birds may be seen tugging at the outside of the old nest, freeing some of the material and flying to the new structure with it. On one occasion, the first nest had fallen to the ground, and the bush-tits alighted on the ground to pull it to pieces.

Return to Nest Site in Subsequent Years.—The birds of nest 1 of 1932 were banded so that the two could be distinguished. In 1933 a nest was built in the same tree, and one of the building pair was a bird banded at the nest in 1932. The mate was unbanded. This is the only instance where the identity of the bird has been definitely known. It was reported to me that in two previous years (1930 and 1931), a nest was built in this

same tree. Again in 1934 a nest was built in this tree, but the identity of the birds was not determined.

That return to the same nest site is fairly common is indicated by the remains of old nests found in the same trees with those of the current year. In one case the second year nest was built in the identical twigs, with the entrance facing in the same direction as the nest of the previous year.

Second-season Nests.—Rarely nests may last through the year to be used again the following spring. The majority of them fall to the ground a few weeks or months after being deserted, the break occurring in the neck just below the hood. Usually those which last over the winter are not used a second time. But one nest was reported to me by A. H. Miller as being used a second season. This nest was built in a pepper tree about 20 feet from the ground above a sidewalk in Berkeley, California. The birds raised a family in the nest in 1932. In 1933 it was remodeled. New lichens and mosses were added to the outside and materials were carried inside as well, so that the structure took on a fresh appearance. Later activities of the pair indicated that young were being fed. The nest dropped to the ground during a light wind before the nestlings flew. The identity of the parents was not known, but since it is known that individuals do return to the same nest site in the second year, it is possible that at least one of the above mentioned birds had occupied the nest in the previous spring.

Tendency of Mated Birds to Separate.—In the spring of 1933 it was found, that, in many instances, when birds were disturbed in the course of building, egg-laying, or incubation, the pairs separated and remated with other birds. If only one deserted, the bird which remained at the nest brought a new bird to it. These facts were brought out by color-banding. In no instance was the sex of the banded bird known.

At nest number 2 one bird was banded on March 16, 1933. In subsequent observations it was noted that neither of the birds working on the nest was banded. The banded bird had either deserted or had lost its band. The nest was not deserted. On March 22, 1933, both birds from this nest were banded, as were both from number 1 and from number 11. Observations made on the following days revealed that neither of the birds working at nest 2 wore bands, and that the banded bird from nest 11 was not in evidence. Nest 1 was deserted and one of the pair was later found building in another tree with a new mate. In order to determine whether the birds were deserting their mates or losing bands a new experiment was attempted. On April 7, 1933, both birds working at number 2 were banded and, as a double check, the feathers of the wings and breast were colored with oil paint dissolved in carbon tetrachloride. The mates of nest 9, a new one built about 100 yards from 2, were captured and one of these was banded and painted. Its mate was one of those which had been banded on March 22 at nest 2. It had abandoned its first mate, found a new one and built the new nest. One egg had been laid. On the day following, the two painted and banded birds from nest 2 were seen foraging together, much occupied with preening. On the second day they had deserted the nest and joined a small flock. Both birds exhibited mating actions with new birds. Granting that the disturbances caused by banding and painting were unnatural, the effect on the birds could not be greatly different from those which might be caused by the invasion of the nest by a jay or snake.

In summary, it may be said that bush-tits exchange mates quite readily when disturbed at nesting. When one bird deserts a nest another mate is found to take its place. If both desert, they separate and seek new mates. It is more than likely that there is some correlation with the sex of the deserting bird, but at the time of these marking experiments it was not possible to distinguish between the sexes. It might be suggested that

the gregarious habits of the species during the rest of the year and the constant presence of unmated birds in small flocks during the nesting season are of significance here.

Egg Laying.—When the nest is essentially complete, the eggs are laid. It is, however, rather difficult to determine just when the nest is complete, for the birds often continue building operations during the egg-laying and incubation periods; but the nest always is strong, the hood completed and the lining finished before the first egg is laid.

One egg is laid each day until the set is complete. It is usually laid before 10 a. m. On several occasions the exact time has been determined. In three cases the egg was laid between 9 and 10:00 a.m., one at 9:15 and two between 9:30 and 10:00. One egg was laid before 8:30. When the female lays the egg, she quietly enters the nest and remains there for from ten to twenty-five minutes. She utters an occasional trill. The male sometimes remains silently in the tree, and at other times he flies off into other trees, foraging by himself. If the female is flushed off the nest she goes back immediately. There is little movement within once she has settled herself.

As soon as the egg is laid, the birds resume foraging activities together. The nest is entered from time to time and new material may be brought and added.

Incubation.—Incubation apparently is started on the day the last egg is laid, or on the day before. The burden of incubation seems to be shared equally by the male and female. Incubation activities of banded birds have not been observed where the sex was known, but careful observation has shown that as soon as one bird leaves the nest, its mate enters, and there is no appreciable or regular difference in the length of time which the two birds spend on the eggs. It might be added that only the female develops a brood patch, in spite of the fact that the male also incubates the eggs. In the female the down feathers on the breast region are lost and the area without down is about twice as wide as in the male and extends from the anterior portion of the breast to the anus. As far as has been determined, the brood patch is the only character by which the sexes may be distinguished. In these studies this method was used as often as possible, both birds being captured in the nest at night in the egg-laying or incubation periods, the brood patches examined and the birds banded with distinguishing colors. During egg-laying the female is further distinguished by distention of the abdomen by the egg to be laid the following morning. Eye color was not analyzed carefully.

Several puzzling problems are presented by the activities of a pair of incubating bush-tits. Often, especially on warm days, one gains the impression that the birds do not incubate. Conversely, the eggs are covered almost constantly on cold days. At such times the birds alternate on the nest for periods of from two to fifteen minutes, the average being about ten minutes. One bird enters the nest, and, except for a preliminary trembling of the structure, there is no movement. Often material is carried in and put in place before the eggs are covered. The mate usually leaves the tree, foraging within hearing distance of the nest. The incubating bird remains inside until the second one returns to the tree. The utterance of location or alarm notes by the returning bird serves as a stimulus for the one within to leave. Frequently the mate perches within six or eight inches of the entrance and darts in as soon as the first bird leaves. At other times the bird in the nest leaves it as soon as the notes of the returning mate are heard. This may leave the eggs uncovered, and on cold days the eggs are left for from two to twenty minutes. The bird within generally is silent. There follow the records of the activities of a pair of incubating birds in the course of an hour on a day (May 5) when the temperature averaged 14.5° C. and the sky was overcast:

- 8:30. Neither bird in the nest. Temperature outside, 14.2°C .
 8:31. One bird (1) returned to the nest and entered it immediately.
 8:40. Bird 2 came to the nest with a bill full of feathers and entered the nest when 1 left it.
 8:42. 2 left the nest as 1 was returning from a near-by tree. 1 entered the nest. Temperature, 14.5°C .
 8:58. 1 left the nest and joined its mate foraging in another tree.
 9:10. Both birds returned and one of them entered the nest. The mate remained in the tree.
 9:11. The mate also entered the nest with nest materials and one of them left immediately.
 9:25. The bird in the nest left. Its mate approached, but did not enter the nest and both went off together.
 9:30. One bird returned alone and entered the nest. Temperature 14.7°C . Raining.

At 11:00 a.m. on the same day the temperature had risen to 17.6°C . and between 11:00 and 12:00 the birds continued incubation as indicated above. At 1:00 p.m. the thermometer registered 18.6°C ., the sun was shining, and there was a breeze blowing. Between 1:00 and 2:30 incubation proceeded as before. Nest materials frequently were carried in.

On warm days there seems to be considerable departure from this method of incubation. One seldom flushes a bird from the nest on such a day. The birds spend much time foraging together, and in carrying material into the nest, but they remain within for only a few minutes at a time. Thus there is correlation of time spent on the eggs with warmth of the day. The closely woven and thickly lined bowl probably is relatively warm inside. In order to check on this assumption a thermometer was inserted into a nest containing eight eggs, while another was hung outside. Readings were taken every half hour all day. Unfortunately the pair deserted the nest after this was done, but the existent difference in temperature throughout the day is of some interest. The sun shone on the nest only between 3:00 and 3:30 p.m.

TEMPERATURE WITHIN NEST IN COMPARISON WITH EXTERNAL TEMPERATURE

| Time of day | Temperature within nest, degrees C. | External temperature degrees C. | Degrees differences |
|-------------|-------------------------------------|---------------------------------|------------------------|
| 10:00 a.m. | 17.6 | 15.2 | 2.4 |
| 10:30 | 17.7 | 15.6 | 2.1 |
| 11:00 | 17.8 | 16.9 | .9 |
| 11:30 | 19.2 | 17.9 | 1.3 |
| 12:00 m. | 20.6 | 18.3 | 2.3 |
| 12:30 p.m. | 21.2 | 19.0 | 2.2 |
| 1:00 | 21.8 | 19.8 | 2.0 |
| 1:30 | 22.0 | 19.5 | 2.5 |
| 2:00 | 23.1 | 19.7 | 3.4 |
| 2:30 | 23.6 | 19.6 | 4.0 |
| 3:00 | 23.7 | 19.6 | 4.1 |
| 3:30 | 23.8 | 19.4 | 4.4 |
| 4:00 | 22.5 | 19.2 | 3.3 |
| 4:30 | 21.5 | 18.6 | 3.9 |
| 5:00 | 21.2 | 17.0 | 4.2 |
| 5:30 | 20.4 | 17.3 | 3.1 |
| | | | Average difference 2.8 |

It will be noted that the differences are smaller in the morning than in the afternoon. In some instances the nest is over 4 degrees warmer than outside. This suggests that possibly in warmer weather the temperature would be high enough to make incubation by the birds unnecessary during the middle of the day at least. The difference may also explain why the eggs can be safely left uncovered on cold days for as long as twenty minutes.

Both birds sleep within the nest at night from the time the structure is strong enough to support them until the nestlings have flown. Thus the parents both spend the nights

in the nest during the egg-laying period before incubation is presumed to have begun. If incubation takes place during egg-laying, the eggs should hatch on successive days. Actually, all but one of the eggs hatch on the same day, indicating that although the birds sleep in the nest, there is not enough heat generated to start development of the embryo.

Length of Incubation Period.—In the one set of eggs which was observed closely, the incubation period lasted twelve days, the eggs hatching on the morning of the thirteenth day. Shepardson (*Oologist*, vol. 33, 1916, p. 116) also records an incubation-period of twelve days. In three cases all but one egg hatched on the same day, one hatching on the day following.

Development and Care of Young.—The following accounts are based on detailed studies of one family of bush-tits, and less extended observations on a second. In the first case the nestlings were observed from a few hours after hatching until the morning of the seventh day, when they were killed, presumably by a California Jay. They were removed from the nest between 10:00 and 11:00 a.m. each day, weighed, measured, and photographed.

First day. At hatching the bush-tit is completely naked. The color is light flesh pink in all portions except the bill and the abdominal regions which are a decided yellow. The only evidence of feather tracts is in the region of the primaries and secondaries and on the tail. In these regions points of dark gray indicate the positions of the feathers. The birds are completely blind and the posture is that of the embryo, the neck flexed so that the head rests on the abdomen when the bird is not disturbed. The young are very weak and hardly able to raise their heads to open their mouths for food. No sounds have been noted from first-day birds. The egg tooth is present.

On the first day both parents collect food. Behavior is much the same as during incubation. A parent entered the nest, carrying visible food in the bill. The nest shook for a few seconds and the parent gave utterance to a series of odd chittering notes, which were the only evidence of solicitation noted. They are never uttered outside the nest. Parents remain within the nest, apparently brooding the young, for a period of ten minutes or less. As in the case of incubation, when the mate returns, the bird in the nest leaves and the second one enters. Feeding occurs from eight to twelve times an hour. Since the food is visible, it is therefore not predigested or regurgitated as stated by Wheelock (*Auk*, vol. 22, 1905, pp. 67-68). Lepidopterous larvae found on the leaves of the live oak are brought throughout the nestling period.

Second day. The feather tracts on the wings and tail noted on the first day show darker pigmentation. The oil gland is evident anterior to the tail. Pigmented feather tracts show in the rectal area. The young are now able to turn themselves over.

Third day. The egg tooth is still present and the eyes are closed. The feather papillae on the primaries and secondaries show pigmentation under the skin for a length of three-quarters of a millimeter. The papillae of the rectrices on the tail have pricked through and the papillae of the upper tail coverts show pigmentation under the skin. Pigmentation also shows on the frontal and coronal portions of the head and on the middorsal regions of the body.

A faint note is uttered by the juvenile at this age. When it is disturbed it raises its head feebly and opens its mouth. So faint is the sound that the bird must be held close to the ear if one is to hear it.

Fourth day. The eye slits are more distinct than previously. The rectal bristles have broken through the skin. Pigmented feather tracts are darker on the frontal, coronal and dorsal regions and are evident in the cervical and interscapular regions, completing the line from bill to the end of the dorsal region. Colorless papillae show on the femoral tract. Similar papillae also are evident posterior to the bill, extending along the ventral tract of the cervical region and dividing laterally to form the sternal and abdominal regions.

Fifth day. The eyes are still closed. A spot of brown has appeared on the top of the bill. A second row of rectal bristles has appeared. Pigmentation is evident in the postauricular regions and a semi-circular line of papillae has appeared on either side of the midventral line in the coronal region. The primary and secondary feathers are three-quarters of a millimeter long and the greater coverts of both have just broken through the skin. Pigmented papillae appear under the skin on the alula and on the marginal coverts and humeral tracts. The rectrices are half a millimeter long and the tail coverts are broken through. Pigmentation shows in the pelvic region on the femoral tract and on the crural tracts of the legs. Color has not appeared on the ventral side. The auricular papillae show pigmentation. The faint notes of the bird have become louder. The young are able to pull their heads up and sit up for a few seconds.

Sixth day. The top of the bill is darker than on the previous day. Feather papillae have appeared in two rows in the ocular region and are darker around the ear. All along the middorsal line the feathers have broken through. On the wings the primaries and secondaries are one millimeter long, the greater coverts one-half millimeter, and the middle coverts and humeral tracts have the pin feathers pricked through. The rectrices are one millimeter long. The pelvic region has joined the dorsal region. The papillae of the malar area are pigmented. The wings are held close to the body.

Seventh day. The eyes are still closed. The pin feathers along the back have all broken through the skin. The primaries, secondaries and rectrices are a millimeter and a half long. Pigmentation shows under the skin on the crural region of the legs, the femoral tract and the malar and submalar regions. Papillae of the under greater coverts show.

The weights and measurements of the birds described above are given in the following table:

WEIGHTS AND LENGTHS OF NESTLING BIRDS

| Age | Weight | | Length | |
|-----|------------------------|-------------------------|------------------------|-------------------------|
| | Bird hatched first day | Bird hatched second day | Bird hatched first day | Bird hatched second day |
| 1 | .65 g. | .72 g. | 23 mm. | 25 mm. |
| 2 | 1.05 | 1.07 | 27 | 26.5 |
| 3 | 1.32 | 1.27 | 28 | 31 |
| 4 | 1.75 | 2.12 | 29 | 32 |
| 5 | 2.62 | 2.32 | 33 | 35 |
| 6 | 2.85 | 2.75 | 36 | 37 |
| 7 | 2.98 | | 39 | |

The nestling period of the second brood was fourteen days. On the sixth day the feathers on the wings and tail were just unsheathing. The birds were trilling weakly for food. On the eighth day the feathers of wing and tail were unsheathed to the extent of eight millimeters. One nestling fluttered to the ground from a box about a foot high. On the tenth day one nestling flew out of the hole in the nest through which I had removed two others. The corners of the bill were still yellow, but the remainder of the bill was brown.

The parents of the second brood were banded so that their activities could be followed. As early as the third day careful observation of the behavior of the two birds revealed that one bird did much more feeding of the nestlings than the other. For example, number 1 entered the nest with food ten times within the space of an hour contrasted with three times for number 2. Number 2 spent most of the time hopping quietly about in the nest tree while 1 foraged throughout the territory. The parents of these nestlings did not brood. This may be attributed to the warm weather during the nestling period. In sharp contrast to this, the parents of the first group of nestlings both brooded the young, definitely alternating on the nest. Both birds fed the nestlings equally. In both cases lepidopterous larvæ were fed to the nestlings throughout the period. Fecal sacs were carried as far as fifteen feet from the nest.

Behavior at Nest-leaving.—When the nestlings are ready to fly, the slightest disturbance sends them out of the nest. As one juvenile starts to leave, the impulse apparently spreads rapidly to the others. So quickly do they pop out of the nest, that one has the feeling that the nest has suddenly exploded. There is an incessant medley of juvenal trills.

The juveniles fly a little awkwardly and to a lower level when they leave the nest. They scatter in all directions, often alighting in the grass, uttering the trill all the while. The parents immediately become excited, uttering a rapid succession of alarm notes as they dash from one young bird to another in an evident effort to protect them and to get them together. This is quite a task, for the juveniles fly as far as twenty-five yards from the nest tree.

The parents spend from fifteen minutes to half an hour gathering the scattered family in low bushes or in a small tree. In the meantime the young birds try their wings and trill, but the parents are far too busy to feed them. Feeding starts as soon as the brood is in one place. Often three or four young perch along a limb in a fluffy row with feathers interlaced, in the manner of adult roosting birds. The more precocious members of the brood flutter clumsily from one twig to another and seem to find it difficult to maintain a firm foothold and a good balance. Fifteen minutes after nest-leaving one juvenile was observed making several attempts to secure insects from the limb on which it was perched. It was very clumsy and almost lost its balance each time. The juveniles of one family interspersed normal location notes with the juvenal trill. Half an hour after nest-leaving the young start following the parents in their search for food, begging with trills as they go. They frequently wipe the bill off on a twig, in the manner of adult birds after feeding. The parents spend almost their entire time searching for food for the young. When an adult approaches a young one, it attempts to put the food into the mouth, but if the juvenile does not take it immediately, the adult passes on to another. In this way a fairly even distribution of food is effected.

Subsequent Behavior.—As soon as the juveniles are able to fly well enough to follow the parents, the family moves about in typical flock formation, the parents doing all of the foraging for the young. This takes place at least the day after nest-leaving, and frequently only a few hours afterward on the same day. In one instance the juveniles were still perching in a bush near the nest on the second day after nest-leaving, but this may not be normal, since the birds left the nest early due to banding. Their wings were weak, and they were much clumsier and less active than others.

Feeding by the parents is continued from eight to fourteen days. One family was fed till the eighth day after leaving, when two of the juveniles were seen foraging for themselves, clumsily hanging upside down in search of food. It seems likely that the shortness of the juvenal tail makes this process difficult, since it has been observed that it is impossible for an adult without a tail to do this. The third juvenile of the family was still following its parents and begging with juvenal trills. It was fed by them from time to time, but not as frequently as previously noted. Although trills were still being used, location notes were common.

Begging and feeding were observed in another family up to the fourteenth day after nest-leaving. Feeding of the entire brood lasted nine days, after which one or two individuals were fed at long intervals.

SUMMARY

1. Territorial boundaries are poorly defended. Intruders are weakly repulsed and are often tolerated. A third bird is sometimes allowed to incubate the eggs and feed the young.
2. Nest construction is started by the building of a rim of spider webs. It may be continued by making a short bag which is slowly extended from within, or a long, loose bag may be built as a foundation. The hood and entrance are made by adding material to the back and sides of the original rim until the original hole has been roofed over and the entrance shifted to one side of the top.
3. Time devoted to building varies, the longest time being taken for February nests and the shortest for April nests. Second nests are built more quickly than first nests.
4. Pairs disturbed during building, egg-laying or incubation frequently desert and build second nests, usually with new mates.
5. Individuals have been found to return to the site of the previous year's nest in the second year. Occasionally a nest lasts through to the second season and is remodeled and used again, presumably by the same birds.

6. During egg-laying the parents spend the daytime out of the nest, foraging or collecting nest materials. The nights are spent in the nest, but incubation does not begin until the day before the last egg is laid.

7. On cold days the eggs are incubated almost constantly, the parents alternating about every ten minutes on the nest. On warm days much shorter periods are spent on the eggs, and the parents forage together to some extent. The temperature within the nest averages about 2.8°C . higher than outside. Both birds spend the nights in the nest.

8. Incubation lasts for twelve days, the birds hatching on the thirteenth.

9. The young are naked at hatching and down does not develop. The eyes are closed and remain closed at least through the seventh day.

10. The young are fed solid undigested food from the first day on, and lepidopterous larvæ are carried into the nest a few hours after hatching.

11. During early stages the young are brooded and fed as much by one bird as by the other. Toward the end of the period, one parent does about two-thirds of the foraging and feeding. The mate spends most of the time moving about in the nest tree.

12. The young apparently leave the nest on the fourteenth or fifteenth day.

13. They become independent of the parents within eight days after leaving the nest, but have been seen to feed themselves on the day of nest-leaving.

Palo Alto, California, August 25, 1937.

RELATIONS BETWEEN MAN AND BIRDS IN WESTERN EUROPE

WITH THREE ILLUSTRATIONS

By TRACY I. STORER

There is marked contrast between the conditions surrounding birds in western Europe and in California due to physiographic and climatic differences in the two areas and to the influence of man. In both regions primitive races of mankind levied upon birds for food and for other purposes, but the small human populations in those times left no obvious effect here, and the same may be inferred in Europe. Modern man has been in California for little more than a century, while in Europe his influence reaches back fully two thousand years. There his activities have altered profoundly the conditions of existence for birds. Discounting, for the moment, the important seasonal differences in weather of the two areas and the unlike size and shape of the land masses in the New and Old worlds in their bearing on bird populations and bird migrations, we may examine, in a comparative way, some of these human influences on birds. Observations made in 1934 in France (January), Italy (February), Switzerland and Germany (March-April), England and Scotland (April-July), while studying economic relations of birds and mammals in those countries, form the basis for this discussion.

To aid in visualizing conditions, the land areas and human populations of certain European countries may be compared with those of California. England and Scotland together are about one-half as large with seven times the population, France is a third larger with seven times the population, Germany is a sixth larger with ten times the population, and Italy is three-fourths as large with seven times the population. Thus, these countries, individually, are not greatly different from California in area but have enormously larger human populations. Much of the human population in Europe is grouped in cities and towns, so that there are many local areas with few or no human habitations, while in California people are scattered on farms over much of the non-mountainous part of the state.

A greater contrast between western Europe and California is found in the plant cover and in the degree of utilization of the land. In Europe there are few areas of "wild land" in the sense of our forests, chaparral, plains and desert. Whereas much of California shows human alteration by deforestation, overgrazing, change in water relations, and introduction of alien plants (both farm crops and weeds), many areas here are still natural or wild in appearance and are so, in fact, with respect to the habitats of birds. Europe has scarcely a square foot of land that does not exhibit some cultural alteration; the land is closely utilized for human necessities. There is no "virgin" forest, and there are few or no unaltered swamps, save perhaps in the Scottish highlands, as in Argyllshire. The pleasant English landscape with its scattered trees and hedge-bordered fields is, after all, not a truly "natural" condition, but represents a partial recovery in that direction. Few inferences as to the original wild vegetational cover are possible for western Europe. In England one relict area of lowland marsh, Wicken Fen, near Cambridge, which the National Trust is seeking to conserve as a sample of the once widespread "fens" (of Holland-like character) in Norfolk, requires careful "management" by competent and practical plant ecologists in order to maintain an approximation to the original condition because of the drainage of adjacent lands! In Europe generally, the mapping of life zones is impracticable; ecologic studies there must be restricted to "favorable localities," especially if the student wishes to avoid, in so far as possible, human influences.

The land in western Europe must serve several purposes. Arable land is cultivated intensively to produce human food, other areas are devoted to the production of timber, and the over-abundant waters are confined in canals, lakes, ponds and reservoirs. In England the same or closely adjacent fields may serve for agricultural crop production, for the rearing of a supply of pheasants or partridges for shooting, and for the production of foxes to perpetuate fox hunting. In France and Germany the regimented conifers of a state or private forest stand in neat, closely spaced rows so densely grouped that the ground beneath is heavily shaded and there is little or no other growth. Such artificial "forests" abut on, and alternate closely with, farm lands. In Italy the minutely divided holdings are surrounded by small scattered fruit trees or by grape trellises; if forest or woodland ever covered much of the Italian Peninsula, it early disappeared into the brick kilns of the Romans. Only in parts of the Alps and in the Scottish Highlands are there places that really present a wild appearance. In the latter region the names of numerous "deer forests" indicate that trees formerly occupied land now covered with heather. Thus, birds in Europe must, in the main, find their food and shelter in man-made or man-altered cover of various sorts, far more than in California.

The laws relating to wild life appear in different forms in the several countries of western Europe and none of these publications is distributed free! Germany and Italy now have unified game codes similar to that for California and some other states, while in France, England and Switzerland the legislation and decrees relating to wild life appear in various legislative and ministerial channels.

Documents which give information in this field are:

France. *La Louveterie . . . Ordonnances, Arrêts, Lois, Décrets et Circulaires sur la Louveterie et la Chasse . . .* publié sous les auspices de l'Association des Lieutenants de Louveterie de France avec le concours de M. M. Periere Directeur des Services Administratifs . . . Paris, 1929, 2⁺iv+416 pp., ill. 8°. 45.50 francs. (Laws, decrees, etc., from 1313 to end of December, 1926, relating to wild life are included, pp. 85-272.)

Italy. *La Legge Acerbo sulla Caccia. Commentata per il cacciatore per il riservista e per l'agente preposto alla vigilanza.* Edizioni Sapientia. Roma, 1931, xxx+112+2 pp. 12°. 6 lira.

Testo Unico delle Leggi e Decreti sulla Caccia annotato e illustrato con la relazione al Re, la Dottrina e la Giurisprudenza, e coordinato con il codice penale del 1930. Roma, 1931, 85 pp. 6 lira.

Switzerland. *Loi fédérale sur la chasse et la protection des oiseaux* (du 10 juin 1925). Berne, 1925, 17 pp. (This is the French edition, others in German and Italian, possibly also in Romansch.)

Germany. *Das preussische Jagdgesetz vom 18. Januar 1934 nebst Ausführungsbestimmungen vom 24. Februar 1934 und Satzung des Landesverbandes der preussischen Jäger vom 24. Februar 1934*. . . . Berlin, Paul Parey, 1934, 67+60 pp. 12^o. 1 Reichsmark.

England. *Poachers and Preserves, a handy guide to the Game and License Laws* . . . Sporting Rights & Licenses. By Stanley Savill. London, Police Review Publishing Co., Ltd., 1927, 70 pp. 12^o. 1 shilling.

There is a distinct difference in the attitude of the Latin and Nordic peoples respecting bird life. In France and Italy the small birds, in differing degrees, are classed as game. Thrushes appear on the game list in France, and a host of small species is pursued by Italian gunners or trapped and netted in the various bird-catching devices evolved in that country down through time. Netting of birds is still in vogue in Italy, the practice being recognized and licensed by the game code of 1931. Several books are currently available on the subject, for example, Ghidini's "*Il libro dell' uccellatore colle reti verticali ed orizzontali* . . ." (Milano, Ulrico Hoepli, 1929, xiii+522 pp., ills.) A report summarizing studies of the fixed installations for this purpose in 1931 gave a total of 1890. These are in the central and northern parts of the country (Toschi, A., 1933, *Sulla distribuzione della Uccellande in Italia. Ricerche di Zoologia Applicata alla Caccia*, [No.] VII, Bologna, 32 pp., map). In Italy, rigid reduction of small birds is held to be necessary to the successful prosecution of agriculture; this opinion was expressed even by certain professors in the universities.

The fact that Italy constitutes one of the major migration routes of birds passing twice each year between Europe and Africa has a bearing on both the game and agricultural viewpoints in that country. Numerous paintings in the art galleries indicate the age-long hold of this viewpoint. Thus, one in the Vatican collection by Rosa da Tivoli (1657-1705) includes beside the hunters and their dogs, deer, fox, mallard, partridge, snipe, great woodpecker, thrushes, bullfinch and other small birds among the "game." Another by Arcangelo Resani (1670-1720), titled "*Natura morta*," has small rabbits, a boar, thrush, grouse, green woodpecker, mallard, pintail and other ducks, various dead birds mostly of small size in a basket and on hooks on the wall; also there are two live partridges (decoys?) in a cage. Still other paintings include small birds among the "game." In a gallery at Dresden, one of several such canvasses by a Hollander in the seventeenth century shows numbers of small birds on a skewer. Some of these paintings even include the small European Kingfisher. The painters of these pictures may be presumed to have figured the species commonly considered as game in those days; on this presumption the Latin countries have adhered to the older ideas, while the Nordic countries have changed. It should be said, however, that in Italy at the present time there is a group of bird lovers that opposes the conventional attitude, combats the agricultural argument, and champions the cause of the small birds.

Upon passing from the Latin to the Nordic countries, one has the impression at once of a greater number of small birds. In Switzerland and Germany, such species as the European Blackbird, Song Thrush, Chaffinch, Blue Tit, Coal Tit, and Nuthatch frequently come to attention. This was true even at Freiburg, in Baden, close to important agricultural areas in the upper Rhine Valley. Thus, south of the Alps small birds are trapped and netted, partly on the argument that such is a necessary aid to agriculture, while north of these mountains a different viewpoint obtains and small species are, in the main, protected. An old German illustration, dated 1517, shows farmers using sticks and slings to drive birds (and other wild species) from their crop lands. This is reproduced in Berger's "*Die Jagd aller Völker im Wandel der Zeit*" (Berlin, Paul Parey, 1928, p. 163).

In Switzerland bird protection finds numerous sponsors; the general attitude is more like that in the United States. The Swiss viewpoint, as expressed by Oberforst-inspektor Petitmermet, chief of the Department of Forest, Game and Fish, is that too much protection at the behest of the bird lovers tends to remove species from the game list, whereupon the hunters complain; if small protected species increase too far, the farmers protest.

The German attitude respecting birds also resembles, in general, that of the United States. The only small species (aside from snipe, woodcock, and shore birds) on the game list in the 1934 Prussian Game Law, is the Fieldfare, a gregarious migrant "robin" that forages in winter on open lands. Predaceous birds, such as the Osprey, the buzzards [hawks] and gulls, are subjected to an open season from October 2 to the end of February. The Coot, European Marsh Hawk, European Sparrow Hawk, Goshawk, Heron, Merganser and Crested Grebe may be killed at any time. The latter are considered as competitors of man in respect to supplies of game birds and fish. Gull eggs may be collected until May 15 each year.

Several problems are evidently involved here, a mixture of conservation and human use. One is reminded in part of the earlier "management" of the bird colony on the Farallon Islands off San Francisco where gathering of murre eggs went on year after year with maintenance of a large murre population, while the gull colony was held to a low level through destruction of gull eggs by the men gathering the murre eggs.

A high degree of "management" obtains in respect to game species, both birds and mammals, in Germany. For many years this has been regulated by laws of the various states. Under the Nazi government, the Prussian Game Law of January 18, 1934, unified procedure throughout the Reich. From central headquarters in Berlin the management reaches down through provincial officers ultimately to the local Kreisjagermeister, who is more than a warden, being responsible for actual field management. Operations leading to maintenance of the game supply, such as repopulation, feeding, and the slaying of predators, on private as well as on public lands (state forests), are subject to the approval of the local Jagermeister. Indeed, on each such preserve, even the number of individuals of resident game species that may be shot in any year is subject to official approval. The purpose of such regulations is obviously to maintain the game supply on a basis of continuing yield. The adjustment of differences between farmers and sportsmen regarding damage by game species to agricultural crops is likewise subject to detailed regulation. The rights and obligations of each group are defined, and damage resulting from failure to exercise proper precautions is assessed against the offending person or groups.

Amid this detailed management a pleasing variety and abundance of small birds is to be seen in Germany. The careful management of forests, woodlands and orchards leaves few or no dead standing trees. Hole nesting birds would be at a disadvantage were it not for the numerous bird boxes put up by both townspeople and farmers. Small farms and home properties abutting on the railroad rights of way abound in such boxes erected on slender poles. Here is a hint as to possible necessary aid to birds in areas depleted of dead trees by "clean-up" campaigns in California!

Societies interested in bird protection are numerous in Germany; for example, there are no less than seven such in Munich alone, and the total number and membership in such organizations throughout the Reich are very large. The general result is that small birds abound in the gardens, parks and open woods.

An outstanding example of bird protection and encouragement was seen at Munich in the great "English Garden," so called because the informal character of its planting

contrasts with the geometrical patterns in many German gardens. In this great public park with scattered trees, bushes, lawns, ponds and streams there were numerous feeding stations for birds of various kinds in the trees and beside the footpaths. These were regularly supplied with food of appropriate sort, such as seeds for finches, and nuts and seeds embedded in suet for tits and woodpeckers (figs. 24-26). People sauntering

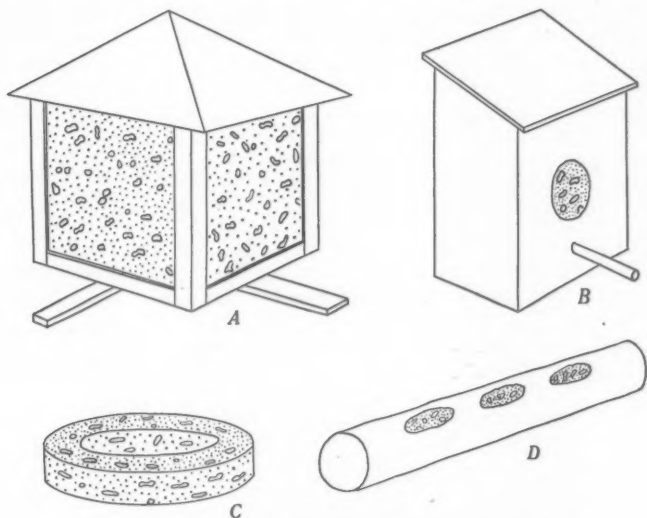


Fig. 24. Bird-feeding devices, using mixtures of suet and nuts, for sale in Munich, Germany. A, "house" of wooden frame, 5"x5", with metal roof, to be suspended by wire. B, wooden block roofed with slab of wood, to be suspended, or fastened to window casing. C, ring of suet-nut mixture, to be suspended. D, portion of branch of tree, the holes filled with suet and nuts; to be hung upside down to exclude finches and suspended by wire so as not to be available to squirrels or mice; dimensions 2"x12".

in the Garden, often carried food for the birds; a few "educated" birds, notably Blue Tits, would even take food from a person's hand. Window ledges of the four- and five-storied residential buildings in the city often had feeding shelves resorted to by Green Finches, Tits, and House Sparrows.

The feeding devices were numerous and varied. Food in these is evidently provided by the park authorities (at least this was true at the time of our visit in March, 1934). A dealer in garden supplies, J. Schmitz, Victualienmarkt, 5, had for sale several prepared suet and seed mixtures. A resident of Munich stated that since this interest in the feeding of birds had developed, some species that were formerly birds of passage now remain through the winter. On the opposite side of the picture there were on sale devices intended to frighten birds from home gardens, such as a piece of blackened sheet metal cut in the silhouette of a cat's head with clear glass spheres for eyes, intended to be hung over a bed of plants, and a series of thin aluminum strips about 1½ by 6 inches in length, to be suspended on a string over a row of plants for the same purpose; however,

agricultural officials reported that neither of these was very successful in keeping birds away.

Falconry is still of interest in Europe, so much so that in Germany there are associations of falconers and a special license is provided, at a low fee, for interested persons.

The general attitude in England and Scotland regarding bird populations is perhaps better known to Americans than that of the continental countries. Legislation and royal decrees regarding the conservation of game, particularly on the lands of royalty and the nobility, dot the legal history of Great Britain. The modern attitude toward general protection of birds began in the latter part of the nineteenth century through action of the British Association for the Advancement of Science. The first specific parliamentary act on the subject dates from 1869. The most important single law was



Fig. 25. Small feeding station, thatched with fir branchlets. Supporting post on some stations surrounded by metal sleeve (English Garden, Munich, Germany).

passed in 1880. Subsequent enactments and governmental orders have markedly improved the status of small birds. An important recent development is that of prohibiting the trapping of small species for caging. An ingenious provision in this law requires that all caged birds offered for sale must have a solid band on the leg, such as can only be placed on during the nestling stage; this precludes capture of free-flying individuals and will force the cage-bird trade to depend chiefly, if not exclusively, on aviary-reared

stock. Posters calling attention to the laws protecting small birds are displayed on bulletin boards at post offices, town offices, and other public places in various parts of England. In consequence of these restrictions, which are well enforced, birds of various



Fig. 26. Large shelter for feeding finches and tits; 6 feet long. Tray below used by finches.

A compartment under roof, protected by screen, is accessible to tits through holes in the end boards (English Garden, Munich, Germany).

species abound in England and Scotland. Public parks have their appropriate quotas and the farming areas have theirs.

Two major items of interest in human relations are the management of game birds and the means taken to protect garden plots from damage by small birds. Where Germany inclines to a program of state supervision in these matters, the English attitude is highly individualistic. A few of the age-old "decoys" for trapping ducks in winter (as described by Lubbock, R., 1879, *Observations on the fauna of Norfolk . . .*, Norwich, Jarrold & Sons, pp. 134-141) still persist in Norfolk. The artificial rearing and release of pheasants under close supervision engages the services of many game keepers in England; on estates with partridges, definite human aid is accorded "to assist nature" by interesting techniques that cannot be detailed here. Grouse on the moors of Yorkshire and in Scotland are supervised, and the heather is burned periodically, in patches, to ensure a crop of young shoots for their forage. On all game lands the destruction of "vermin" is a prominent activity. In consequence, hawks are scarce, although rooks and jackdaws survive despite continued persecution.

England lies too far north to permit of successful commercial production of fruit save in a few southern counties; yet many home gardens, even into the midlands, have a few fruit trees, while vegetable and flower gardens and berry patches are plentiful. These crops are to the liking of the European Blackbird, the Song and Missel thrushes, Bullfinch and other passerines. To conserve such crops for human use, string netting of small mesh is employed in various arrangements, supported over individual plants or covering entire garden plots during the fruiting season. Old herring nets find ready sale for this use, and several manufacturers make special nets for this service (for example, Walker's Fruit Tree Protectors, Ltd., Brecon, South Wales). The growing

and harvesting of such garden crops for table use would not be practicable in many localities without these nets. Indeed, one plant pathologist at Harpenden finds it necessary to enclose with nets his annual crop of experimental cereals grown for use in study of plant diseases to protect the plants from the "English" Sparrow. Such nets also are used in Bavaria to protect grain from doves. The introduction of this technique into American and Californian gardens merits consideration, although its application to commercial plantings has practical limits.

Sale of game is a regular practice in European countries. In Germany and England this can be done without endangering the future supply because the management plans provide for shooting from the local populations of game species each year no more than can be safely spared on a basis of continued yield. Such sale is not practicable in America where this type of regulation is absent. Dealers in game in England must obtain special licenses and in Germany the whole matter is incorporated in the Prussian Game Law, with specific arrangement for storage of game marked by lead tags in refrigerator warehouses, to be withdrawn as needed.

Game birds and mammals were on sale in practically all of the larger cities visited. In each of these effort was made to find markets displaying such materials. Less was seen in England because of the lateness of the season. Some of the offerings noted were as follows, the figures in parentheses indicating approximate value in American dollars at normal gold exchange:

Paris (January 21): wild mallard, 22 francs (87 cents); woodcock, 17 francs (67 cents).

Nimes (January 26): lapwing (*Vanellus*), 3 francs (12 cents).

Rome (February 11): wild mallard, 9 lira (47 cents); pheasant, 16.5 to 18 lira (87 cents); snipe, 3 lira (16 cents); large thrush and European blackbird [size of American robin], 1.4 to 1.6 lira (7.3 to 8.4 cents).

Munich (March 22), cold storage supplies: pheasant, 2.0 to 2.5 reichsmarks (44 to 55 cents); partridge, 0.8 to 1.0 reichsmarks (17 to 22 cents).

London (May 3), cold storage supplies, imported: hazelhuhn [equivalent to ruffed grouse], 1 shilling, 3 pence (30 cents); Russian ptarmigan, 1 shilling, 3 pence (30 cents).

In Rome during mid-February, a Rotisserie where cooked meats were sold had small passerine birds alternated with slices of bread on a rotating spit before a fire.

That all is not well with even so favored a song bird as the Skylark is indicated in a recent report from London that indicates complaint by farmers of damage to their crops by this species.

What then may be inferred from the European picture, as to the future, ornithologically speaking, in California? I think that with the growth of human civilization in California, we may expect that most, if not all, of our bird species will continue to exist. Application here of the "sportsman's" attitude with regard to predators and game, despite important differences in local conditions will, I fear, decrease further our birds of prey; our best efforts at education and legislation will aid these species only in limited degree. Further introductions of alien birds, despite advice and laws to the contrary, may shift the balance in respect to a few native birds, especially game species. More intensive activities may be expected here in respect to actual management of game bird populations. The recent waves of protest from farmers regarding bird damage to crops and from naturalists against invoking control measures will in time reach an equilibrium more nearly acceptable to both interests. Continued development of public parks and private gardens will compensate in considerable degree for destruction of wild cover. Our bird populations may be expected to persist, with but limited modification, for many generations.

Division of Zoology, University of California, Davis, California, December 31, 1937.

OBSERVATIONS ON THE EFFECT OF A SPRING DROUGHT ON REPRODUCTION IN THE HUNGARIAN PARTRIDGE

By PAUL L. ERRINGTON and F. N. HAMERSTROM, JR.

Our data on the introduced Hungarian Partridge (*Perdix perdix*) in northwest Iowa were secured incidental to studies of other wild species and hence have their expected shortcomings. Even so, they may be of interest from the standpoint of natural history, particularly in view of the fact that one of the three breeding seasons (1934) during which notes were taken was characterized by extreme spring drought that continued until early June.

Totals of 26 partridge nests and 25 broods of young birds were observed chiefly in Clay and Palo Alto counties, although data on 14 of the broods were contributed from neighboring counties by John F. Holst, Jr., and by other deputy game wardens. Contemporaneous data on other ground nesting birds and on the food habits of avian and mammalian predators were gathered in the same general area and serve to supplement the limited data we have on the partridges themselves. The work was carried on in connection with the cooperative research program of Iowa State College and the Iowa Fish and Game Commission, 1932-1935, with the aid of financial contributions from J. N. Darling.

The spring drought of 1934 naturally was attended by scanty growth of ground cover. Dry grass and weed clumps of the previous year afforded initial concealment for many nests, but "short pastures" forced the farmers to graze their stock along roads, fence rows, and borders of marshes, with resulting detriment to the nesting habitats of the birds frequenting such places. Midsummer rainfall was followed by some recovery of vegetation and improvement of environmental conditions for the partridges.

The season of 1933 may be judged "normal" and that of 1935 was unusually wet. The data on partridges for these two years may for purposes of this paper be handled collectively. Seven of 15 nests were known to have been successful and these were all begun in May. In contrast, only one of 11 nests observed in 1934 was known to have produced young and this was begun about the middle of June. The success or failure of two of the 1934 nests was not determined, but circumstances indicated that they probably failed.

Although data from only 26 nests may not provide the most representative basis for an evaluation of nesting losses, the ratios of different types of losses to each other did not seem to vary significantly in the years with which we are concerned. Aside from losses that may be classed as miscellaneous, for example, the intentional breaking up of a nest by a farmer who claimed that partridges had taken some of his young chickens the year before, nest failures in drought and non-drought seasons had much in common. Ten of 14 fence row and roadside nests failed, as did 6 of 8 hayfield (mostly alfalfa) nests. Two nests situated in pastures failed, while two in barley fields succeeded. There were the usual losses from abandonment or destruction of nests after disturbance or exposure by mowing machines or livestock and the usual pilfering by such egg-eaters as the crow (*Corvus brachyrhynchos*) of eggs thus made conspicuous and easily available.

So far as we can see, the nesting losses of 1934 differed from those of 1933 and 1935 principally in the increased scale upon which they occurred, and this in turn may be attributed in large measure to the exceptionally unsatisfactory status of nesting habitats during the period of drought. Hungarian Partridge nests were placed in roughly the same types of cover as were chosen by the Blue-winged Teal (*Querquedula discors*) and the Ring-necked Pheasant (*Phasianus colchicus torquatus*); Bennett (Trans. 21st Am.

Game Conference, 1935, pp. 277-282) described a striking rise in rates of loss in 1934, for duck nests in comparable localities, but Hamerstrom (Iowa State College Jour. Sci., vol. 10, 1936, pp. 173-203) did not find this to be true for pheasant nests.

Seven of the 26 partridge nests contained pheasant eggs, and all of these mixed clutches were begun either very early in the nesting season or at other times when the prevailing cover conditions were decidedly inferior. Of the 11 partridge clutches observed in 1934, 5 were thus mixed, compared with 2 of 15 clutches for 1933 and 1935. Bennett (Iowa State College Jour. Sci., vol. 10, 1936, pp. 373-375) found between 40 and 50 partridge nests in the course of his duck studies in northwestern Iowa in the years 1932 to 1935, and he lists four of these as containing pheasant eggs. In the 10 mixed clutches (including Bennett's data) for which we have fairly complete figures was a total of 33 pheasant and 114 partridge eggs. We do not feel entitled to draw many conclusions as to the significance of pheasants and partridges laying in each others nests, but the incidence of this "parasitism" in 1934 may in itself reflect an unusual shortage of acceptable nesting sites and a consequent increase of interspecific competition and desertions.

Approximate ages of partridge broods were calculated from field notes and with the help of Yeatter's (Univ. Mich. School Forestry and Conserv., Bull. 5, 1934, p. 37) growth curve. For 1933 and 1935, the data show that 9 of 11 broods were hatched between the latter part of May and the middle of June and that the other two may have hatched not much later. In 1934, the hatching dates of 6 of 14 broods fell in the middle of June, 6 from late June to early July, and 2 nearer the middle of July.

Despite the adverse nesting conditions and the high rate of nesting failures observed in 1934, we believe that by virtue of continued re-nesting later in the season the partridges succeeded eventually in raising a substantial number of young birds. It is our impression from casual field observations and consideration of data on general predation that population levels of the Hungarian Partridge in northwestern Iowa were somewhat lower in the winter and spring of 1934-1935 than in 1934 at the beginning of the drought, but that they were still materially higher than they were in 1932-1933.

In the case of the Ring-necked Pheasant, successful re-nesting seemed to compensate for the nesting losses suffered from 1933 to 1935 in the areas under observation (Errington and Hamerstrom, Jour. Wildlife Management, vol. 1, 1937, pp. 3-20). While the pheasant broods for 1933 and 1934 show uniformity in average number of young per brood at comparable ages, those data that we have for the partridges give an average of 5.5 young at an average age of 7.6 weeks for 1933 and of 4.9 young at 5 weeks for 1934. If 11 broods in 1933 and 14 in 1934 represent a large enough number of samples for comparison, it becomes questionable whether the smaller brood average in 1934 may be more correctly ascribed to the drought than to a possible rise in rates of juvenile mortality accompanying greater population densities. The latter phenomenon has been reported for the Bob-white (*Colinus virginianus*) in Wisconsin (Errington and Hamerstrom, Iowa Agr. Exper. Sta., Research Bull. 201, 1936, pp. 420-422) and probably relates to many other wild species.

Consulting the available data on food habits of local predators, we find no significant change in pressure of the Marsh Hawk (*Circus hudsonius*) on partridges in the summers of 1933 to 1935. Partridges (mostly young birds) constitute a total of 9 or 1.62 per cent of 557 items of prey (Errington and Breckenridge, Amer. Midl. Nat., vol. 17, 1936, pp. 831-848).

Unpublished data from analyses of Great Horned Owl (*Bubo virginianus*) pellets from "partridge country" reveal that for the spring and summer of 1933, only 1 or 1.5

per cent of 65 pellets contained partridge remains; for winter, 1933-1934, 11 or 5.9 per cent of 185; spring and summer, 1934, 14 or 10.5 per cent of 133; winter, 1934-1935, 8 or 4.1 per cent of 195; spring and summer, 1935, 11 or 7.3 per cent of 151. The heavier pressure of Horned Owls in the spring and summer of 1934 does not necessarily point to an increase of vulnerability of partridges because of the drought, in as much as the pressure during the preceding winter was correspondingly heavy.

The partridge carcasses found as food items at dens of the red fox (*Vulpes* sp.) rose from 8 or 0.79 per cent of 1010 in 1933 to 59 or 2.07 per cent of 2848 in 1934; only 1 or 0.09 per cent of 1175 spring and summer fecal samples for 1933 contained recognizable partridge remains, compared with 18 or 1.93 per cent of 935 samples for 1934 (Errington, Ecology, vol. 18, 1937, pp. 53-61). The increase in 1934 in representation in the diets of the foxes was thought to be associated both with higher population densities of the partridges and with greater vulnerability due to the drought.

On the whole, we doubt that the adverse conditions of 1934 resulted in any drastic change in the population of the Hungarian Partridge in northwestern Iowa, though they were not without effect. The ecological picture seems to be essentially one of retardation and decreased productivity of the nesting season rather than one of ultimate failure.

Iowa State College, Ames, Iowa, and University of Wisconsin, Madison, Wisconsin, September 24, 1937. (Journal Paper No. J490, Iowa Agr. Exp. Sta., Project No. 329.)

THE STATUS OF THE FOX SPARROW OF SOUTHWESTERN OREGON

WITH TWO ILLUSTRATIONS

By JOHN E. CUSHING, Jr.

In May and June of 1936, I collected a number of Fox Sparrows (*Passerella iliaca*) in the mountains of southwestern Oregon. On Onion Mountain, 15 miles west of Grants Pass, Josephine County, the birds were plentiful and twenty-six were taken. Near Bolan Lake, Josephine County, and close to the California line, four more were collected. As far as can be told from my reconnaissance of this part of the state, the breeding range of the species probably extends northward along the coastal mountains to the vicinity of Powers, Coos County. The purpose of this paper is to determine the status of the above mentioned specimens and to see if they throw any light on the problem of the summer home of *Passerella iliaca megarhynchus*.

I wish to thank Mr. James Moffitt of the California Academy of Sciences and Dr. Alden H. Miller of the University of California for their valuable suggestions and help in the preparation of this paper. In fact, Mr. Moffitt's advice that I collect Fox Sparrows while in Oregon served to initiate this study.

In identifying the Onion Mountain birds, skins representing the following races were used: *P. i. brevicauda*, *mariposae*, *fulva* and *megarhynchus*. These were in the collections of the Museum of Vertebrate Zoology at Berkeley, and in the California Academy of Sciences, San Francisco. Only adult males were considered, and effort was made to compare birds taken under similar seasonal conditions. Of *megarhynchus*, only winter birds were examined, for breeding individuals, as far as known, have never been collected.

The first character to be considered is that of color. The striking feature of the Onion Mountain birds is their dark pigmentation. Though taken at the end of June, when their feathers were considerably worn, these skins are darker than those of all

other races, resembling most closely skins of *mariposae*. With reference to the other subspecies discussed in this paper, I feel safe in saying that, in general, color plays a minor role as an aid to distinguishing the races. It is worthwhile pointing out that the Onion Mountain series has bluish, heavily pigmented mandibles in contrast to the conspicuously yellow ones of *megarhynchus*. The latter resemble *fulva* and *mariposae* in this respect and also have comparatively light colored feet and claws. The comparison of bill and foot color has been objected to on the grounds that seasonal fluctuations and the age of skins might affect the degree and kind of pigmentation. However, evidence obtained from examination of various skins of *mariposae* tends to invalidate this criticism.

A careful visual comparison of bill size and shape points toward the following relationships. *Brevicauda* has the largest bill of all the subspecies studied. Next, in decreasing order of size, is the Onion Mountain group, followed by *mariposae*, with *fulva* having the smallest of all. This is in close harmony with the actual geographic positions of the various races. In actual size, bills of the Onion Mountain birds seem closest to *mariposae*, although in shape they incline toward the heavier, stubby bill of *brevicauda*. *Megarhynchus*, to the eye, appears to have a bill intermediate in size between that of *mariposae* and that of *fulva*. From this, one can see that the hypothesis that *megarhynchus* is the breeding bird of the southwestern coastal mountains of Oregon is not favored, for the Onion Mountain group does not identify itself with the winter-taken specimens of *megarhynchus* from southern California.

Wing and tail measurements are of small diagnostic value among the northern California *Passerella*, as Swarth has already demonstrated (Univ. Calif. Publ. Zool., vol. 21, 1920, pp. 75-224).

The characters thus far considered have proved of relatively slight importance for racial differentiation. However, with respect to bill measurements, real differences

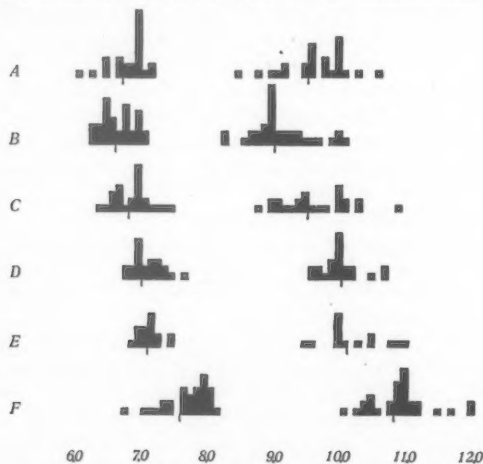


Fig. 27. Histograms representing bill measurements, in millimeters, of races of Fox Sparrow. Bill width on left; length on right. A, *P. i. megarhynchus*; B, *fulva*; C, *mariposae* (Plumas County); D, *mariposae* (Siskiyou County); E, *mariposae* (Josephine County); F, *brevicauda*.

become apparent, and it is chiefly upon this evidence that my conclusions have been based. Three measurements were made: first, the length of the bill, taken from the anterior end of the nostril to the tip of the maxilla; second, the width at the base of the mandible; and third, the depth of the base of the maxilla. These measurements were made upon as large a number of breeding males from each single area as possible. In no case were there less than fourteen individuals from any one region considered. The following is a list of stations from which the specimens whose measurements were used were obtained: for *fulva*, Sugar Hill, Parker Creek, Davis Creek, Willow Ranch, Buck Creek and Cedarville in Modoc County, California; for *mariposae*, Johnsville and Mohawk in Plumas County, Applegate and Blue Canyon in Placer County, Jonesville in Butte County, Weed, Salmon Mountain and Gazelle Mountain in Siskiyou County, California; for the Onion Mountain birds, Onion Mountain, Josephine County, Oregon; for *brevicauda*, Ruth, Yolla Bolly Mountain and South Fork Mountain in Trinity County, and Knob, Shasta County, California; and, finally, for *megarhynchus*, series chiefly from Los Angeles and Tehama counties.

Three graphs of the three kinds of measurements were made, two of which are reproduced here (fig. 27). These show well the interrelationships of the various groups. The Onion Mountain birds, instead of being closest to *megarhynchus*, as Swarth's paper



Fig. 28. Map showing regions from which breeding Fox Sparrows were examined. Letters represent the same groups shown in figure 27.

would lead one to suspect, are most closely related to *mariposae* and appear to be a northward extension of this race as well as a connecting link between it and *brevicauda*. The winter-taken *megarhynchus* overlap extensively with *fulva* and their average is intermediate between those of *mariposae* and *fulva*. Further study of the graphs shows that there is a nicely graded blending among the various races of Fox Sparrows, with the least, however, between *brevicauda*, on the one hand, and *fulva* and *megarhynchus* on the other. These facts, coupled with the evidence from the Onion Mountain series, do not agree with Swarth's statement (p. 162) that "*megarhynchus* is most nearly like *brevicauda*."

This disagreement becomes increasingly marked as one considers the geographic correlations of the average bill measurements. On a map (fig. 28), the Onion Mountain group is seen to form part of a chain of groups with increasing bill size, running from the vicinity of Johnsville, Plumas County, north to Onion Mountain and from there south to the vicinity of Yolla Bolly Mountain, Trinity County. *Megarhynchus*, contrary to what had been expected, does not fit into this chain at any point where breeding birds have not been collected, at least as far as can be told from the measurements.

To my knowledge no specimens of *Passerella* have been taken on the western slopes of the southern Cascades in Oregon. As this is the most favorably situated area of large enough size to support a race of Fox Sparrow, it is possible that here may lie the unknown breeding grounds of *megarhynchus*. This falls in with the evidence obtained from measurements, but of course the area needs to be explored in order to obtain necessary factual material.

Another possibility is that the race *megarhynchus* does not exist as such in nature, but instead has been "synthesized" from certain similar variants of other races. Such a mishap is possible, but insufficient work has been done to allow further discussion of it.

To conclude, *megarhynchus* is not the breeding Fox Sparrow of the southwestern mountains of Oregon as was formerly supposed. Instead, this area is occupied by a connectant population of *mariposae* that intergrades between *mariposae* of the Siskiyou area and *brevicauda*. This means that the breeding ground of *megarhynchus* is as yet undiscovered and may lie, if the race exists as a natural population, on the western slopes of the southern Cascades in Oregon.

San Francisco, California, January 21, 1938.

ENVIRONMENTAL FACTORS AFFECTING WATERFOWL IN THE SUISUN AREA, CALIFORNIA

By JAMES MOFFITT

Upon reading Stoner's record of ducks shot in the years 1882 to 1907 on a gun club near Cygnus, Solano County, California (Condor, vol. 39, 1937, pp. 242-248), some recollections based upon twenty-five years' experience with the ducks of the Suisun marsh area came to mind which I believe should be taken into consideration in analyses of this sort. Nothing that I state here is intended as criticism of Stoner's interesting paper, the thoughts being presented as suggestions to be borne in mind when evaluating data of this kind.

Environmental conditions for ducks have changed greatly in this region since the first shooting club was organized in 1879. No doubt many alterations traceable directly and indirectly to civilized man affected the Ibis Club grounds, of which Stoner writes,

in the period in which bag records were kept. Some of these changes unquestionably resulted in fluctuations in relative abundance of different species by making the habitats for the individual kinds increasingly or decreasingly attractive. Furthermore, before the first club was established, conditions on this marsh may have been changed by man, by silting of the bay and ponds and perhaps by increased salinity of the water due to early hydraulic mining operations. Originally the Lesser Snow Geese (*Chen hyperborea hyperborea*) made the ponds on this marsh by tearing up clumps of three-square (*Scirpus americanus*) to secure its bulbs for food, just as McIlhenny (Auk, vol. 49, 1932, p. 287) has so graphically shown the Blue Geese (*Chen caerulescens*) of Louisiana do. Then, the Whistling Swans (*Cygnus columbianus*), working in the areas opened by the geese, deepened the ponds to three feet or more by tilting up like surface-feeding ducks and reaching down with their long necks. Plant growth, of which sago pondweed (*Potamogeton pectinatus*) is by far the most important one locally, becomes established when ponds with proper conditions of salinity and requisite depth (18 inches or more) are created. Sago pondweed, an excellent food plant, attracts surface-feeding ducks, notably Pintail (*Dafila acuta*), until the ponds are deepened so that the growth is no longer within reach of the surface-feeders. The ponds then become attractive to diving ducks, of which the Canvasback (*Nyroca valisineria*) is the only common one in this region. Canvasbacks in their feeding operations, may further deepen the ponds. The carp, an introduced fish in California, fortunately is not common in the Suisun marsh area but is abundant in other duck habitats in California. They also deepen ponds and are tremendously destructive to food plants.

In the Suisun region, Mallards (*Anas platyrhynchos*) are common along some sloughs and the bay shore where there are thick growths of hard-stem bulrush or common tule (*Scirpus acutus*). They are only to be found in numbers on the marsh in ponds bordered by this growth or by cattail (*Typha latifolia*). This duck is especially fond of tideland tule thickets where openings permit it to alight and to feed on the fallen seeds of the plant. Green-winged Teal (*Anas carolinense*) to some extent share this feeding habit with Mallards. In my experience on the marsh, I have seen a good mallard pond ruined for this species through destruction of the tules by overgrazing of cattle, and in other instances hogs have caused similar damage. At the same time, these domestic animals have made certain areas more attractive to some birds, such as Wilson Snipe (*Capella delicata*). Winter tule burning, widely and long practiced by gun clubs on this marsh, keeps down thick growths bordering shooting ponds where many crippled birds would be lost. Although it is of benefit in this way, it destroys much duck food, cover, and shelter. The last is an important item at times of high wind, when ducks are seen to congregate in numbers to the leeward of tule thickets, levees and other sources of protection.

Originally, of course, water flowed freely over the Suisun marsh at periods of high tide. This condition must have resulted in there being proportionately many more Mallards present in early days. Sometimes today, and probably originally too, in times of high tides accompanied by heavy rains and river flood waters most of the marsh is covered, in places to considerable depths. At such times it is either unattractive to most kinds of ducks, or other areas, newly flooded by the same rains, are so much more attractive that few birds are then found on the marsh.

In the first years of shooting clubs, as shown by McAllister's map of the Ibis Club grounds in 1888 (*op. cit.*, p. 245), the ponds were not diked off and protected by flood gates, but the tides were permitted to flow freely in and out of them. Early in local gun

club history, low levees were erected by Chinese hand labor with flood gates to control the depth of water on the properties. As high tides often overflowed these low dikes and inundated the grounds, with the coming of dredge equipment higher levees were built to permit man to regulate the depth of water in the ponds. This technique is so important in creating optimum conditions for ducks that it is usually supervised by one man in each club. Thus have developed some of the best practical "duck ecologists," men who know to an inch the depth of water on their grounds most attractive to a certain kind of duck and from whom many professional "game managers" could gain a wealth of information.

Since Pintail are the most numerous, and to gunners the most desirable, species in the vicinity, it is for them that conditions are usually made attractive. Canvasbacks are also much sought, but only clubs having deep ponds or sloughs can hope for numbers; I know of no instance where deep ponds have been locally man-created for this bird. It seems almost certain that the Ibis Club grounds were altered by the construction of dikes and that control of water during the period of record resulted in a much reduced kill of Mallards. This fact plus the difference in habitats noted by Stoner and the different periods of years covered by the reports, seem to explain the large variation in numbers of Mallards killed on the Ibis and on the adjoining Tule-Belle clubs (*op. cit.*, p. 246).

The "overflow," while not affecting conditions on the Ibis Club grounds in the period of records because the first one was not created in the Suisun marsh until about 1912, is an innovation which so drastically affected the old-time, natural deep ponds that it should be mentioned here. In the natural ponds, in which water is in so far as possible kept under 18 inches in depth for surface-feeding ducks, the principal natural duck food is sago pondweed. In ponds well seeded by this plant which are not completely dried out in summer and which are flooded in late summer with water that is not too saline, such rank growths of this weed develop by early October as to render difficult rowing a boat or wading through them. It is in these favorite ponds that the early arriving surface-feeders, chiefly Pintails, congregate to feed. Within a few weeks, or usually by mid-November, most ponds are entirely stripped of this growth down to the extent of surface-feeding ducks' reach. After that, the birds are forced to feed at the edges of the ponds where they seek less easily obtainable sustenance, or they go elsewhere to feed. For this reason, the wise shooting ground manager will keep the water as shallow as practicable in the ponds in the early season and after the exhaustion of the "nut-grass" (local name for sago pondweed) will from week to week increase the depth of the water so as to open up succeeding areas of marginal feeding grounds. Prior to its prohibition, bait was also used to keep the birds on the ponds after depletion of the "nut-grass."

As stated, the "overflow" was conceived about 1912 and so successful were the first ones in providing enlarged feeding grounds, more desirable habitats for certain surface-feeders and therefore better gunning, that in ensuing years, through the 1920's, more and more clubs were forced by the competition of others to construct them. Briefly, an "overflow" is a flat piece of marsh land diked off and flooded to a uniform depth. Practically, in the Suisun area, lands largely devoid of "pickle-weed" (glasswort, *Salicornia*) were chosen if available because this plant provides little duck food and crowds out more valuable plants. If "pickle-weed" was present, its eradication was attempted by plowing or by submergence. After enclosing the area of the "overflow" with dikes and after eradication of "pickle-weed," only sub-soil moisture was provided in summer, with shallow flooding, again carefully regulated, in the hunting season.

Many natural food plants sprang upon lands so treated among which of greatest importance is a small composite with yellow flower and succulent leaves which is avidly eaten by surface-feeders. Thus, relatively large areas of ecologically attractive land were created for the birds, which drew a far greater population of Pintails to the locality in the peak years in the late 1920's than existed on the marsh at any previous time in the course of my observations since 1913. As intimated, the relatively more attractive "overflows" tended to draw the birds away from the old, deeper ponds with the result that very poor shooting was had on many of them after "overflows" became numerous.

While attractive to Widgeon (Baldpate, *Mareca americana*) and teal, as well as to Sprig, the "overflows" are not particularly sought by Shovellers (*Spatula clypeata*). This species seems to be most numerous on the Suisun marsh in periods of high water when most of it is flooded. They apparently are attracted chiefly by the abundance of floating insect food thus made available. Teal alone seem attracted by flooded "pickle-weed" and perhaps chiefly by the insect food thus afforded. Possibly the reason that this species alone among the surface-feeders is commonly found in this environment lies in its small size which permits greater mobility among the rank growths that this plant characteristically forms. The largest aggregation of Green-winged Teal that I have ever seen, about 6000 individuals, came to a field of "pickle-weed" south of Suisun shortly after it was flooded by a levee break, where they remained for three weeks. Smaller concentrations frequently have been observed locally in similar situations. Mallards are not at all attracted by "overflows."

Canvasbacks are the only diving ducks which are common on Suisun Bay and marsh. On the marsh they are restricted to sloughs and ponds over two feet in depth, and they prefer deeper ones. Upon arrival in October and November, they first visit marsh waters of requisite depth affording sago pondweed, being especially fond of its tubers. When this food is exhausted and unless held on the club grounds by bait (usually wheat which is greatly preferred to rice or barley, or sometimes chopped potatoes which they avidly seek), the Canvasbacks resort to the bay, feeding largely on small clams and other animal food. Since the birds roost on the bay from the time of their arrival, including the period when they feed in the marshes, it appears that pondweed and grain are foods favored over animal matter. It was an easy matter for clubs with proper water conditions and good growths of pondweed to "hold" Canvasbacks on their properties with bait long after the birds had cleaned out the natural food supply. After baiting was abolished, so far as the clubs were concerned, Canvasback shooting ceased for the season with the exhaustion of natural food. But this did not mean that many "Cans" were not shot after they left the marsh, for when feeding in the bay they were prey for the sculler and bay-shore decoy gunner. It did, however, result in much poorer tasting birds being shot, for when the Canvasbacks fed on vegetable matter in the marshes their flesh was delicious and free from fishy taint, but soon after they commenced feeding in the bay they became so strong in flavor as to be relatively undesirable for food.

It proved difficult for some clubs with proper water conditions to establish Canvasback shooting by heavy baiting alone, though the species was locally abundant. While sago pondweed has a moderately high tolerance for salinity, it dies out when a certain concentration is reached. Thus a levee break permitting an influx of strongly salt water to a slough where good Canvasback shooting obtained for years, killed this plant growth off with the result that these birds for a long period ceased to visit the grounds, although bait was exposed for them. When the pondweed began to re-establish itself, a few Canvasbacks appeared and more the next year, with increasing numbers coming in successive

seasons until a fine flight was regained after the natural food became plentiful. Since bait was placed in all years, the results indicate that abundance of pondweed was the important factor, and that it required years of experience to draw more and more ducks to the ponds, possibly old ones returning with their young or bringing other birds with them season after season. Thus, numbers of waterfowl cannot always be quickly attracted to an area simply by the placement of food, but it may take years to build up a large population.

Another instance of destruction of Canvasback feeding grounds occurred about 1928 on Suisun Creek adjoining what is now the Suisun State Game Refuge. At that time this property was used as a gun club, but the marginal tidewaters of the creek were (and are) according to law "open" shooting territory. A small tule island here provided cover for the hunter without trespassing on the club lands, and the intervening bed of the creek held some food, probably animal, that for several years had attracted numbers of Canvasbacks. Some of my friends and I, and other "unattached" gunners here secured a number of large bags of these birds. Either annoyed by our success or by the reports of our guns, the adjacent property owner had the tule island removed and the bottom surrounding it dredged out, ruining the duck food supply. The birds ceased at once to visit the locality and have not since been observed there by me, indicating that the food is not yet re-established. Up to about fifteen years ago, the tidal sloughs of Suisun marsh provided feeding places, and in times of heavy winds the banks afforded protection for numbers of ducks of different kinds, including besides Canvasbacks and a few Lesser Scaups most of the local surface-feeders, notably Mallards and Teal. There, especially in stormy weather, the non-affiliated gunner could at times enjoy good sport. Much increased travel by man, especially by bass fishermen in outboard motorboats, has since so disturbed the birds that few now resort to the sloughs.

Salinity, shown to be an important factor as regards sago pondweed, likewise has a strong effect upon other plant and animal life. The increased salinity of the waters of Suisun Bay and its tidelands, which came with greater use of water from its tributary rivers for irrigation, became acute in the drought years of the early 1930's. Salinity was knowingly avoided by all informed duck club managers by storing fresh water for summer use from the June freshets and as sparingly as possible adding to it the salty water of autumn until the rains brought relief. Of late years mosquito control work on the Suisun marsh has presented a serious obstacle to this plan and is resulting in the destruction of many duck food plants. The technique of this work involves ditching to tap all pools and low-lying land and keeping water circulating during the summer, or else draining the ground dry. The former treatment results in circulating through the land in summer, strongly brackish water which is often far above the limits of tolerance for salt of many desirable plant species. Mosquito control, coincident with the abolition of baiting, has made it doubly difficult for property owners to keep their grounds attractive to ducks. Thus, it will have an adverse effect upon land values and taxes levied in the district, because experience has shown the land to be unsuited to profitable agriculture and worth little for purposes other than hunting.

If mosquito control work had not so destroyed the inherent abilities of the land to produce duck foods, a land owner conceivably might develop by clever management a natural food supply sufficient to continue to attract enough birds to provide good sport after the prohibition of baiting. Under conditions existing on the Suisun marsh in the late 1920's, enough natural food was produced to hold the then larger population of birds there without baiting until well into November. It argues that the same amount of food now would keep the smaller quantity of ducks for a longer time. It has always

been the experience on this marsh that if food exists, the birds remain in numbers until heavy rains flood areas elsewhere, thus providing new and better feeding grounds. Normally such conditions do not occur until mid-December or later, but this year (1937) much of California's lowland was overflowed before the shooting season opened on November 27. Thus, for all of California a wider distribution and lesser concentration of ducks is to be expected as the season advances. This is an excellent argument for a late open season on waterfowl in California which would avoid concentrated gunning and would distribute the birds more evenly over the state. One fair objection to this proposal, however, comes from sportsmen in northeastern California (Tule Lake, Modoc and Lassen counties) and east of the Sierra, where a late opening date might find the ponds frozen and the waterfowl absent. This objection could be overcome by declaring a different open period for the area, similar to that for contiguous Oregon and Nevada where this year's open season is the month of November; but the plan has the fault that many hunters from the southwestern area would travel to the region to take advantage of the earlier season, resulting in a concentration of gunners with probable overshooting.

Another matter of importance to be considered in the interpretation of bag records over a period of years is the preference of gunners for certain species. Generally the larger birds, Mallard, Pintail and Canvasback, are shot in preference to others, although some hunters especially like to bag teal. When there was no bag limit, prior to 1901 in California, gunners were not so selective of their game as later and tended to shoot almost any duck that flew by. This, I think, explains to a large degree, the high percentages of Widgeon and of Ruddy Ducks (*Oxyura jamaicensis rubida*) in the record of the Ibis Club, for the latter species and Buffleheads (*Bucephala albeola*) have not to my knowledge been purposely bagged other than rarely in this locality in the course of the past 25 years. Thus, their present complete protection under federal statute means nothing locally. No doubt a greater degree of selection of game prevailed at the Ibis Club during the period when the duck limit was 50 per day, 1901-1906, but the quantity was still high enough not to induce such selection as developed later. In 1907 the limit was reduced to 35 ducks per day and two years later, to 25, where it remained until federal regulation cut it to 15 a day in 1931, 12 in 1933 and 10 in 1936, with complete protection afforded to several locally unimportant species in 1931 and to Canvasbacks in 1936. Weekly state bag limits of twice the daily limit resulted in no conservation of ducks on the Suisun marsh where clubs long ago voluntarily agreed to shoot only two days a week (Wednesdays and Sundays) as a means for providing better sport. During the time that the daily limit was 25 ducks, hunters tried to take straight "limits" of one species, preferably Canvasbacks or Pintails, with the result that proportionately fewer birds of other kinds were killed, and this practice became more general with further limit reductions. In the past 25 years, relative numbers of Widgeon, Green-winged Teal and Shovellers have decreased markedly in California as compared with Sprig. Too much stress, I think, has been laid on reduction of breeding grounds as a cause and not enough to the fact that these kinds have been shot off in greater proportion than the Pintail. Even though the latter is more desirable, the former kinds are much less wary and decoy more readily than do Sprig.

As further evidence for the operation of the factors which have been discussed, percentages of species bagged by a shooting club on the Suisun marsh with grounds similar to those of the Ibis and Tule-Belle clubs combined (natural ponds, and shallow and deep sloughs) are provided for the period 1919-1926, inclusive, as follows:

| | |
|--------------------|------|
| Mallard | .5 |
| Pintail (Sprig) | 49.7 |
| Widgeon (Baldpate) | 22.3 |

| | |
|-----------------------|------|
| Teal | 16.3 |
| Shoveller (Spoonbill) | 7.5 |
| Canvasback | 3.6 |
| Gadwall | } |
| Lesser Scaup | |
| Ring-neck | |
| | .1 |

These records should be compared with Stoner's (*op. cit.*, p. 246), especially with his percentages of combined kills of both clubs. Outstanding is the great increase of Pintails. This species in my table about equals all other kinds combined. The low percentage of Canvasbacks is explained by the fact that the period of record covers one of the poor years for this duck on this club due to temporary depletion of natural food. The grounds are not suited to Mallards.

The combined records agree in indicating that the Sprig is the commonest duck, followed by Widgeon, Teal, Canvasback, Shoveller, and Mallard, a conclusion which checks with my observational evidence over the 25-year period. These are the only ducks that can be termed "common" on the Suisun Marshes and Bay. Ruddy Ducks and Lesser Scaups (*Nyroca affinis*) are still to be classed as fairly common on deep water, the latter on the Bay only. The Ibis Club records of "Black-jack" unquestionably include perhaps as many Ring-necked Ducks (*Nyroca collaris*) as "Bluebills," for the colloquial name "Black-jack" is used by some gunners for both kinds and others are unable to distinguish them. My experience has shown the Ring-neck to occur on the marsh nearly as frequently as does the Lesser Scaup. Buffleheads are rather uncommon on the marsh while Gadwalls (*Chauelasmus streperus*) and Redheads (*Nyroca americana*) appear now to be even less numerous than formerly. No doubt a few Gadwalls are scored as Mallards and some Redheads as Canvasbacks in the club records, but my observations indicate that both are relatively rare visitors locally. Golden-eyes (*Bucephala clangula americana*) are only fairly common on the bay and infrequent visits on the part of this species to the marsh are apparently confined to young of the year and to females.

Among the mergansers, all of which are grouped by gunners as "fish ducks" and are seldom shot and if so never saved for food, my experience indicates that the Red-breasted (*Mergus serrator*) is almost entirely restricted to the bay, where it is not numerous. The American Merganser (*Mergus merganser americanus*) is, conversely, to be seen chiefly on the marsh where it has been noted but sparingly by me in mid-winter only, especially in cold winters. The Hooded Merganser (*Lophodytes cucullatus*), likewise restricted to marsh waters, is rare and I have but one local record, a female in my collection shot near Teal Station, December 19, 1915. Wood Ducks (*Aix sponsa*), indicated by Stoner's records (*op. cit.*, p. 246) to have been not rare on the Ibis Club in early days, are now seldom seen on the marsh. Not more than four instances of this duck's occurrence have been reported to me in the past 25 years (one killed near Suisun, October 9, 1927; others reported since then). In view of this species' successful "comeback" in the Sacramento Valley where it is at present abundant, it is strange that more Wood Ducks are not now seen on the Suisun marsh. Occurrences of other kinds of ducks in this area are to be regarded as accidental. I have one record each for Fulvous Tree Duck (*Dendrocygna bicolor*) and Old Squaw (*Clangula hyemalis*), the latter recorded by J. W. Mailliard (Condor, vol. 18, 1916, p. 85). Scoters of at least two kinds and Greater Scaup (*Nyroca marila*) surely occur on Suisun Bay at times, but I have no definite records.

Among the geese, the Lesser Snow has been much the most numerous kind throughout the period of my observations. Several thousands of these birds winter regularly in the area and so far as I know have roosted at night exclusively on Joice Island, both before and after establishment of the state game refuge there. I have a number of times noted flights of this species back and forth across the mountains north of Suisun, assuming them to represent travels to or from the Sacramento Valley. Occasionally many more than the normal number of these birds may be present for several days. While this condition has been observed principally during periods of flood, or of freezing weather, in the Sacramento Valley, the largest local concentration of Snow Geese coming under my observation occurred in mid-November. At least 20,000 white geese spent November 17, 1929, on Suisun Bay where pursuit by gunners often drove them to flight and provided excellent opportunities to estimate their numbers which I conservatively placed at this figure. The outgoing tide drifted the two-mile-long "raft" of birds down opposite Martinez by late afternoon when all arose, most of them to alight on mud banks exposed on the northeast side of the bay; but several large flocks flew over Pierce Station and Cordelia, to disappear in the northerly direction of Williams or Arbuckle in the Sacramento Valley. Partly on account of their habits, but mainly because gunners do not relish their flesh, white geese have formed a relatively small part of hunters' bags in proportion to their relative abundance in the region. Stoner's surmise (*op. cit.*, p. 247) that the local birds are referable to *hyperborea*, the lesser form, is assuredly correct, for the larger race, *atlantica*, is almost unknown west of Atlantic coastal waters.

Next to Snow Geese in point of abundance come the White-fronted (*Anser albifrons albifrons*). Because of their tender flesh, they have even supplanted Canada Geese in the hunters' favor. I have recorded the presence of the Tule Goose (*Anser albifrons gambelli*) on this marsh (Condor, vol. 28, 1926, p. 241), and more recently have found this large form to be fairly numerous locally in some years in midwinter. Five were shot (3 preserved) from flocks totalling 150 or more, 1 mile east of Pierce Station, December 28, 1932, whence others were reported about the same date in the preceding and following years. One of the birds secured was heavily coated with crude oil. Numbers of Tule Geese were observed adjoining the north boundary of the state game refuge, 4 miles south of Suisun, on January 14 and 17, 1931.

Of the Canada Geese, *Branta canadensis canadensis* is the only race which now regularly visits the Suisun marsh, where it is a late winter visitant in small numbers. Probably not more than 700 Honkers, all told, are to be found on the marsh in recent years of average visitation. Because of their wariness, relatively few of these birds are shot. Heermann (Pac. Railroad Rept., vol. 10, part 6, no. 2, 1859, p. 67), as noted by Stoner has presented under the title "Hutchins' Goose," a graphic description of enormous numbers of geese which visited the area in early days, and his remarks upon feeding habits may correctly be applied to those of the much smaller numbers of Snow and White-fronted geese wintering there today. Heermann's account indicates that the Lesser Canada Goose (*Branta canadensis leucopareia*), which name has since replaced Hutchins' Goose (*Branta canadensis hutchinsi*) for the middle sized "Canada" goose abundant in California in winter, was formerly numerous on the marsh. This bird is so scarce now locally as to be of only casual occurrence, although it is still abundant in the interior valleys of California. In the period 1919 to 1925, when I frequently hunted for ducks on a club 4 miles south of Suisun, only one Lesser Canada Goose was bagged (November 2, 1919) and a small flock was noted on Suisun Bay, seven days later.

The Cackling Goose (*Branta canadensis minima*) apparently was never a regular visitant to Suisun marsh; report of but one bird being shot has reached me in the past 14 years. It seems that this form has always preferred to winter farther inland in California, and it and the Lesser Canada are still rather numerous late seasonal visitors to Maine Prairie (see Stoner, *loc. cit.*, p. 247) and to the neighborhood of Rio Vista, Solano County, where ecological conditions are those of the interior valleys rather than of the Suisun marsh. These appear to be about the westernmost localities in the San Francisco Bay region regularly visited by these kinds. Other geese, including the Ross (*Chen rossii*) are of but casual occurrence on the Suisun marsh.

Whistling Swans are now quite common winter visitants to the area. Certain ponds, like the Pringle Pond $1\frac{1}{2}$ miles southwest of Suisun, are favorites for the species and have been considerably deepened by their feeding operations.

The most important innovation affecting ducks instituted by man on the Suisun marsh in the past 25 years was the establishment in 1932 of a state waterfowl refuge of 1711 acres on the middle section of Joice Island. This refuge has annually saved more ducks in the shooting season than all other conservation measures combined. Because the large number of ducks still wintering on the Suisun marsh quickly depletes the natural food supply of the refuge, they continue to feed mainly on other grounds which are principally owned by shooting clubs. Before the refuge was established, on calm shooting days the surface-feeding ducks sought refuge from the guns by rafting on Suisun Bay, where they were considerably persecuted by scullers and other kinds of hunters. In windy weather the bay became unattractive to surface-feeding ducks when the waves forced them to fly to marsh ponds. It was in such weather that marsh gunners made their biggest kills. Now that the refuge is available and apparently large enough to accommodate most of the local duck population, the birds seek safety on it, especially in stormy weather. The ducks continue to feed on the club properties on non-shooting days, but soon after the Wednesday and Sunday morning bombardments commence, most of them quickly learn to fly directly to the refuge where they spend the rest of the day, and so well do they recognize its safety that they cannot be frightened from it by an airplane or other means.

The federal prohibition of recent years of shooting ducks before 7:00 a.m. appears to me to be too drastic and unpopular a measure to continue for long. In this latitude it results in not being legally permissible to shoot until long after daylight. It has saved some ducks on the Suisun marsh, as elsewhere, but there seems to be a limit to the degree that it is wise to invoke unpopular laws because of the danger of breaking down respect for other more important measures. Personally I believe that return to the half-hour-before-sunrise regulation that was in vogue for years, would be wise and would work for better reception of more important modern duck legislation on the part of gunners. Since shooting on the Suisun marsh for years has ceased almost universally by one or two o'clock in the afternoon, the present 4:00 p.m. daily cessation law means nothing locally.

California Academy of Sciences, San Francisco, December 15, 1937.

FROM FIELD AND STUDY

Behavior of Northern Phalaropes.—The first of the Northern Phalaropes (*Lobipes lobatus*) began to appear on the lakes of Golden Gate Park, San Francisco, about the middle of August, 1937, increasing in numbers as the days went by so that by the first week in September there were several hundred birds scattered over certain of the lakes. Some of the lakes the phalaropes avoided almost entirely.

I do not know for how many years the phalaropes have used the lakes of Golden Gate Park as loafing and feeding stations during their fall migrations, but I do know that they appear much more at home in the park than they did in 1936. In that year they were not especially shy, but on the other hand they were not friendly to the human visitors who came to feed the ducks. This year, when people came to cast bread on the water, the phalaropes crowded in to get their share of the food. At South Lake the phalaropes were especially tame. When bread was thrown on the water, the birds hurried from all sections of the lake. The birds that were farther away came on the wing and those that were nearer paddled their jerky way. Soon many were mingling with the ducks and were jabbing eagerly for the smaller crumbs.

By spinning rapidly on the surface of the water the clever phalarope creates a whirling current that brings the water-logged bits of bread to the surface. I actually saw this magic take place while the bird was only three feet away. The spinning habit of the phalarope is well known, but I doubt if it is generally known that the phalarope is also an excellent flycatcher. As I watched the phalaropes, it seemed to me that no bird floats more lightly on the surface of the water and that no bird takes more easily to the air. Time and again I saw birds rise almost straight up from the surface of the water to pluck flying insects from the air. Often a bird would rise fifty feet above the lake to capture a passing insect.

Another day I saw Northern Phalaropes display their flying ability under different circumstances. It was on September 22, 1937, while I spent a sunny hour sitting on the shore of South Lake in Golden Gate Park. A Virginia Rail came out from cover to paddle leisurely along the shore of the little island. I was studying this rail through the binoculars when suddenly the leisurely bird put on a burst of speed and dashed to cover. Looking up I discovered the cause of the excitement; a Sharp-shinned Hawk, on wings of the wind, was trying to snatch one of the six phalaropes from the surface of the water. The phalarope dodged and took to wing, and was going in the opposite direction when the hawk swooped by. The hawk surely could have made a kill had it been willing to take a ducking in order to gain a phalarope for its lunch. Possibly the hawk was not very hungry, or perhaps it was in its mind that here were several phalaropes remaining on the lake, any one of which might furnish a meal. Time after time the hawk circled and came swooping down over a phalarope.

The phalaropes were wise and were reluctant to leave the water. Not once was a phalarope foolish enough to leave the water before the oncoming hawk. Always they would dodge when the killer made the swoop, and always they left the water going in the opposite direction when speedy wings were carrying the killer away. Not being able to frighten a phalarope into leaving the water ahead of its stoop, the hawk was doomed to forego its luncheon. However, when the last remaining phalarope took to wing, the hawk made a desperate attempt to pluck it from the air. The hawk made a quick turn and followed the phalarope. Seemingly he could travel at about twice the speed of the phalarope, but he could not turn or dodge so quickly. After dodging the hawk six or seven times, the phalarope managed to get above the hawk and there it was safe, for the hawk did not attempt to strike from below, nor could the hawk outwing the phalarope in upward flight.—CHARLES W. MICHAEL, Pasadena, California, November 15, 1937.

Fire Ants Attacking California Quail Chicks.—Ants of the genus *Solenopsis* may destroy from 4 to 12 per cent of Bob-white Quail nests in Georgia, attacking and eating the helpless chicks as they emerge from the shell (Stoddard, The Bobwhite Quail, 1932, p. 193). In Arizona, ants (genus not determined) are reported to attack and kill not only hatching chicks but also incubating females of both Gambel and Scaled quails (Gorsuch, Univ. Ariz. Bull., vol. 5, 1934, pp. 76-77). Apparently ant depredations on California Quail have heretofore escaped notice.

At Davis, California, fire ants (*Solenopsis xyloni* and *S. molesta*) have been found swarming over the shells of recently hatched eggs of the California Quail (*Lophortyx californica californica*) on a number of occasions. In the course of detailed observation of thirty-two quail nests at this locality in 1936 and 1937, only one case of actual destruction of hatching chicks was noted. The nest (U. F., 1937, 11) in this instance was in an unusually exposed site in a small nut orchard only 50 feet from a paved sidewalk. Four days before the set of eleven eggs had been completed a grass fire had removed practically all protective cover and had actually scorched the shells of five of the eggs. Incubation, however, was carried on until July 25 when the eggs were due to hatch. At 5:50 that

morning the female bird was observed approaching the nest and behaving in a peculiar manner. Instead of sinking onto the nest and settling down quietly, she walked back and forth and around the nest in a listless manner for 50 minutes, passing within a few inches of her eggs half a dozen times. Finally, she stopped and for ten minutes squatted over the nest with head erect and eyes alert. Then suddenly she flew off to join her mate at the creek 100 yards away.

Upon examination, the entire nest was found to be swarming with *Solenopsis xyloni*. One egg was nearly hatched and the chick, half out of the shell, had already succumbed; a large part of its head had been eaten away. Another egg was pipped and a dozen ants had gained access through the hole, barely two millimeters in diameter. The chick within was still alive but had been so injured by ant bites and stings around the eye and mouth that it failed to recover in an incubator to which it was removed. The remaining nine eggs were unpipped and unharmed.

After carefully clearing away all organic waste, a ring of ant powder (sodium fluoride and pyrethrum) was sprinkled in the dust around the nest to prevent further invasion. The treatment was successful, but the bird failed to return until 7:15 that evening. One of the remaining eggs hatched successfully on July 28; the other embryos had evidently died at an early stage of incubation.—JOHN T. EMLEN, JR., *Division of Zoology, University of California, Davis, California, November 23, 1937.*

Creepers Nesting in Solano County, California.—On May 29, 1937, while making a "breeding-bird census" for Bird-Lore along Green Valley Creek, about five miles northwest of Cordelia, Solano County, California, I was surprised to locate a nesting Sierra Creeper (*Certhia familiaris*



Fig. 29. Nesting site of Sierra Creeper in a dead laurel stub (center) near Cordelia, Solano County, California.

zelotes). Looking into the end of a badly decayed laurel stub, four feet high and five inches in diameter, J. D. Graham of Benicia, who accompanied me, found four young birds. They did not seem to be Western House Wrens, which were nesting commonly here, so I waited for a few minutes and was rewarded by seeing a creeper, with a spider in its bill, light on the trunk of an adjacent laurel tree three or four feet away. As soon as it saw me at the nest, it commenced to utter a *tsip-tsee* note, and several times flew toward my head as though attempting to drive me away, returning each time to the near-by tree trunk. It entered the nesting cavity only after I had withdrawn a little distance.

The nest was open to the sky in the hollow tip of the decayed stub about six inches down in the hole, the inside measurement of the cavity being approximately three inches in diameter. The nest was of fine, thread-like bark strips, matted with feathers and decaying wood dust. I recognized one of the feathers as that of a Steller Jay, and several were from a Horned Owl. The nesting stub was so badly decayed that it would have snapped off with very little pressure.

I visited the nest again on June 6 at which time the four young birds were still in the nest, though evidently about ready to leave. On that date I took the accompanying photograph (fig. 29) and noted that there was one addled egg in

the nest which I withdrew and prepared for my collection.—EMERSON A. STONER, *Benicia, California, September 22, 1937.*

The Timberline Sparrow in Arizona.—While collecting birds near Springerville, Apache County, Arizona, in October, 1937, I noticed flocks of Vesper and Brewer sparrows foraging in a wheat field along the Little Colorado River, 4 miles west of town. An immature male Brewer Sparrow, taken on October 8, has since been identified as *Spizella breweri tavernei* by Dr. H. C. Oberholser

of the Bureau of Biological Survey. The skin has been deposited in the Biological Survey Collections at the U. S. National Museum.

This specimen is apparently the first Arizona record for the Timberline Sparrow and one of a very few collected in the United States. The subspecies has been reported from central-southern New Mexico by Grinnell (Condor, vol. 34, 1932, pp. 231-232) and from central-western Texas by Van Tyne (Auk, vol. 53, 1936, p. 92).—JAMES O. STEVENSON, *National Park Service, Washington, D. C., November 30, 1937.*

Another Saw-whet Owl from the San Bernardino Mountains, California.—I recently examined a mounted specimen of *Cryptoglaux acadica acadica* that was taken by Roger Zachary, of Los Angeles, at Crestline, about 5000 feet altitude in the San Bernardino Mountains, October 27, 1937. The bird was taken alive, but died after a few days in captivity.—G. WILLETT, *Los Angeles Museum, Los Angeles, California, December 1, 1937.*

An Unusually Early Molt in the Ruddy Duck.—Although it is not unusual to see Ruddy Ducks (*Oxyura jamaicensis rubida*) in partial nuptial plumage by early March, Phillips (Nat. Hist. Ducks, vol. 4, 1926, p. 161) gives March 18 as the earliest known date at which this plumage has been found complete. It was therefore a matter of considerable surprise when, in the late afternoon of January 3, 1938, a male of this species was seen in the western part of Stow Lake, Golden Gate Park, San Francisco, in complete breeding plumage.

This individual was no more than twenty-five yards from shore when seen, and it afforded ample opportunity for close scrutiny. The unworn and unfaded appearance of the feathers precluded the possibility that this might be an old male that had failed to molt its nuptial plumage the previous autumn.

This same individual was observed at this locality on ensuing days and on January 7 a careful check was made of all the Ruddy Ducks on the lake. On this day about 75 individuals of this species were seen, of which approximately one-half were males. A careful examination of each bird through field glasses showed only one additional male to be in other than full eclipse plumage which is normally retained during the autumn, winter and early spring until late March or April. This bird had black on the head but not as yet on the nape. A considerable spotting of chestnut was present on the mantle, scapulars and sides.—ROBERT T. ORR, *California Academy of Sciences, San Francisco, January 11, 1938.*

An Incubating Male California Quail.—It is well known that in the California Quail (*Lophortyx californica*) usually the female alone incubates the eggs. The fact that sometimes a male quail is found incubating was noted by Grinnell, Bryant, and Storer (Game Birds of California, 1918, p. 529) who wrote: "The male bird will assume the duties of incubation if the female is done away with, but otherwise seems only to perform the duty of sentinel."

But such instances do not seem to be common, for E. Lowell Sumner, Jr. (Calif. Fish and Game, vol. 21, 1935, pp. 217, 254) in the course of thirty months of intensive field work on the

California Quail never observed the male incubating and he only mentions one such case, that of a nest observed by the writer and others on the Stanford University campus in 1933.

It was with interest, therefore, that in 1936 on approaching a quail nest for purposes of photography I found the male incubating the eggs (fig. 30). Thirteen eggs were in the nest which was in a field just west of the Stanford campus. This nest was observed several times each day, on June 29, 30, July 1, 2, 3. Only the male was found on the eggs and nothing was seen of the female. On July 4 the nest was found broken up. Four of the eggs were missing, and many scattered feathers indicated the capture of the bird by some predatory animal.

At neither nest, in 1933 or 1936, was the female observed at any time. This fact tends to confirm

the suggestion of Grinnell, Bryant, and Storer that males found incubating are not sharing the duty with the female but have taken it over after she has been killed.—JOHN B. PRICE, *Stanford University, California, November 29, 1937.*



Fig. 30. Male California Quail incubating.

Further Records from St. Lawrence Island, Alaska.—In two small lots of bird skins from St. Lawrence Island, Alaska, recently received from Paul Silook, an Eskimo collector resident at Gambell, in the northwestern part of the island, are several birds of interest. Three of these are new to the known fauna of the island, and one of them is new to the territory covered by the A. O. U. Checklist. All specimens are now in the U. S. National Museum.

Anthus gustavi. Petchora Pipit. An unsexed specimen, in winter plumage, unfortunately without definite date other than "1937," is the first of its species to be recorded from within the political boundaries of North America. This pipit breeds in Kamchatka and the Commander Islands west to northern Russia, and migrates ordinarily through China to the Philippines, Celebes, and the Moluccas. To find one far to the northeast of the breeding range, just exactly in the opposite direction from the migration route, is indeed surprising.

Limnodromus griseus scolopaceus. Long-billed Dowitcher. One specimen in breeding plumage was taken at Gambell; no date other than "1937." This species has not been recorded from St. Lawrence Island before, but there is nothing remarkable about its occurrence there.

Nettion carolinense. Green-winged Teal. A "female" (a male by plumage), taken at Gambell on May 16, 1936, is the first record for St. Lawrence Island. Nelson (Birds of Bering Sea, 1883, p. 88) stated that this duck "undoubtedly" occurs on the island, but until now no definite record was available. The specimen is definitely the American, and not the Old World, Green-winged Teal.

Anser albifrons albifrons. White-fronted Goose. One adult, unsexed, Gambell, May, 1937. Previously this species was known as a St. Lawrence bird only from osseous remains.—HERBERT FRIEDMANN, United States National Museum, Washington, D. C., January 3, 1938.

Notes from Buena Vista Lake, Kern County, California.—Upon learning that the Kern River was again flooding into the old Buena Vista Lake basin, W. J. Sheffler, G. B. Thomas and the writer decided to investigate the influx of bird species that were to be found breeding there in former years before the lake dried up. We spent the week-end of June 19 and 20, 1937, in scouting the shore lines of the lake and in making notes as to which birds seemed to favor, with respect to possible nest sites, the different types of submerged and newly sprouted vegetation. On these dates, the water obviously was still rising. Many nests were being built, but few eggs were in evidence. Colonies of Forster Tern (*Sterna forsteri*), Black Tern (*Chlidonias nigra surinamensis*), Western Grebe (*Aechmophorus occidentalis*) and the Pied-billed Grebe (*Podilymbus podiceps podiceps*) were located, and much nest building activity was evident in each. Sheffler took one set of Western Grebe eggs on this trip, the only eggs found on the surface of the water with the exception of countless eggs of the American Coot (*Fulica americana americana*).

On July 4 and 5, 1937, with the addition of Sid Platford to our party, we again visited the lake, this time bringing a portable row boat. We found a disastrous state of affairs at the colonies that had been located previously. Nests of Forster Tern and Black Tern were flooded out, and many eggs of several species were floating about on the surface of the water. The only surviving nest with eggs of Black Tern at the colony was placed on a partly burned fence post which rose with the water level, the other nests all being flooded and destroyed. Similarly, a nest and eggs of the coot was placed on a floating piece of 1"×12" pine board. Plant growth was so abundant that it anchored the floating wood sufficiently that the prevailing winds did not shift the nests more than a few feet one way or another from day to day.

A large nesting colony of Black-crowned Night Herons (*Nycticorax nycticorax hoacili*) was found in flooded willows, there being dozens of nests only a few feet apart and all containing fresh eggs on this date. Only a few scattered individuals of White-faced Glossy Ibis (*Plegadis guarauna*) were observed and no nests were located.

Of particular interest was the scarcity of ducks of all species. Although a few were seen, it seemed doubtful if many were able successfully to raise broods because of the continually rising water. A nest of Cinnamon Teal (*Querquedula cyanoptera*) was located early on the morning of July 5 under a small bush on the dry land about one hundred yards from the shore. It contained five fresh eggs at that time, but when I returned later in the day to photograph it, there remained but one egg, although the female flushed upon being approached. The consensus of opinion regarding the disappearance of the other four eggs seemed to point to a gopher snake as the culprit.—J. STUART ROWLEY, Alhambra, California, January 20, 1938.

Occurrence of the Marbled Godwit on the Coast of Oregon.—The occurrence of the Marbled Godwit (*Limosa fedoa*) in the state of Oregon has so seldom been recorded that when it does stop with us in its northward or southward migration, the event seems worthy of record. While looking over the numerous migrating shore birds at low tide on August 16, 1937, at Yaquina Bay, near Newport, Lincoln County, Oregon, three Marbled Godwits were noted on the exposed mud flats. The birds were collected and all three proved to be males. They have been mounted and are now

part of the bird collection at the Braly and Currier Natural History Museum at DePoe Bay, Oregon. The identity of the specimens was verified by Stanley G. Jewett of Portland, Oregon.—J. C. BRALY, *DePoe Bay, Oregon, December 20, 1937.*

Two Gull Records for California.—On March 4, 1936, when in the company of James Moffitt, I shot an adult Glaucous Gull (*Larus hyperboreus*) at Suisun, California, some five miles west of Grizzly Island. The capture was notable in the fact that the bird was an adult, a small female. The plumage was fully adult with no trace of immature markings but, as is often the case, the bill showed a smudge of dusky toward the tip and the orange marking at the angle of the lower mandible was very dull in color. The iris was the normal pale straw color of the adult. A notable feature was the presence of faint gray cross bars near the tips of the two longest primaries that suggest the supposed hybrid *Larus nelsoni*. The bird was picked out from a company of Herring and California gulls which rose from the bank and circled overhead as we passed down stream in a boat.

On February 29, 1936, T. T. McCabe and the writer hired a launch to take us out to sea from Santa Cruz, California, in search of pelagic birds. On the return to port, when some seven miles out, I shot a Yellow-footed Gull (*Larus occidentalis livens*), an adult female, from the "tail" of gulls that McCabe had attracted by throwing out cut-up bait. The bird had light saffron-yellow feet, and the color of mantle and the measurements agreed with specimens in the Museum of Vertebrate Zoology and in my own collection from Baja California. The ovary was slightly enlarged. This establishes a record considerably to the north of any previous one. A few minutes later a specimen (nearly adult) of the northern race, *Larus occidentalis occidentalis*, was collected.—ALLAN BROOKS, *Comox, B. C., December 25, 1937.*

A New Race of Horned Lark from the Region of Great Salt Lake.—In the course of a study of the variation and distribution of the horned larks of western North America it has become apparent that those horned larks breeding in the eastern part of the Great Basin, particularly in the region of Great Salt Lake, are, as a population, distinct from all other races. It is therefore proposed that they be separated as a new race with the name

Otocoris alpestris utahensis, new subspecies. Great Salt Lake Horned Lark.

Type.—Adult male, no. 66312, Mus. Vert. Zool.; 10 mi. W Salt Lake City Airport, Salt Lake County, Utah; September 11, 1934; collected by D. M. Behle.

Diagnosis.—In fresh plumage, *utahensis* somewhat resembles *O. a. leucolaema* but the feathers of the dorsum have blacker centers and ashy rather than brownish edgings, thus producing a decided ashy-gray aspect on the entire back which contrasts markedly with the prevailing brown color-tone of *leucolaema*. The color of the bend of the wing and of the nape varies in individual males of *utahensis* from Pale Vinaceous to Drab Gray (names of colors capitalized are those of Ridgway, 1912). In breeding plumage, when wear has removed the highly diagnostic ashy-gray color, *utahensis* differs from *leucolaema* in its deeper tone of the nape which varies individually from Fawn Color to Vinaceous Tawny, and in its darker back which is grayer than the sandy brown of *leucolaema*. The new race is close to *enthymia* in general pallor, but it differs from that race in being smaller, more ashy, and with much more yellow on forehead, eye-stripe and throat. *Utahensis* shows close resemblance to *O. a. lamprochroma*, which occupies contiguous territory to the westward. In fresh plumage the feather edgings in this latter subspecies are more brownish-buff in color, and thus it has a slightly darker gray-brown tone than the chalky-gray of *utahensis*. In worn plumage, the situation as seen in fresh fall plumage is reversed, for *utahensis* is darker than *lamprochroma*. Also *utahensis* has no streaking on the nape region, such as one frequently encounters in examples of *lamprochroma*. The Great Salt Lake race differs from *occidentalis*, the race next to the southward, in much the same way as it does from *leucolaema*. It lacks the deep brown of *occidentalis* and is much less rufescent on the back.

Measurements.—Average and extremes for breeding males (38 specimens): wing, 103.9 mm. (107.5-100.4); tail, 70.4 (74.1-66.0); bill from nostril, 9.5 (10.5-8.1); tarsus, 21.2 (23.0-20.0); middle toe without claw, 10.8 (12.2-9.5). Breeding females (12 specimens): wing, 96.8 mm. (99.5-95.5); tail, 62.4 (66.0-60.0); bill from nostril, 9.1 (9.8-8.5); tarsus, 20.5 (21.2-20.2); middle toe without claw, 10.6 (11.8-9.2).

Geographic Distribution.—Breeds in the eastern part of the Great Basin, that is, in eastern Nevada in Elko and White Pine counties; in Utah west of the Wasatch Mountains, and in southern Idaho.

Remarks.—It is planned to present details of the distribution and variation of this race at a future time in connection with similar data on the other races of horned larks in western North America. It is felt advisable at this time merely to present a diagnosis of the new race.—WILLIAM H. BEHLE, *Museum of Vertebrate Zoology, Berkeley, California, December 15, 1937.*

Midwinter Records from the Vicinity of San Diego, California.—For the past sixteen years the writer has participated, with other members of the San Diego Society of Natural History, in the annual Christmas Bird Census which is sponsored by the National Association of Audubon Societies. The route followed each year has been essentially the same. Many of the species recorded have been found in the same territory at each visit, if the character of the region has remained unchanged by man. For example, we have found one or two Vermilion Flycatchers (*Pyrocephalus rubinus flammeus*) at a certain pond near National City six times in the last seven years.

The 1937 census, which was taken on December 22, included two species heretofore not recorded as winter birds for the vicinity of San Diego. On that date the writer, in company of Clinton G. Abbott and Samuel G. Harter, watched a Western Least Bittern (*Ixobrychus exilis hesperis*) for almost half an hour as it perched in the tules at the edge of a small pond on the north side of Sweetwater Valley near National City.

Frank F. Gander and James E. Crouch, who also participated in the census, confined their observations to the water front and recorded twenty-eight American Knots (*Calidris canutus rufus*). The large number of this species observed and the fact that the knot had not previously appeared in the San Diego census raised the question of correct identification. So the day following, December 23, the writer and Mr. Gander again visited the beach on the bay side of the strand south of Coronado. Three knots were found and one of them collected, thus establishing the bird's identity. Mr. Gander stated that in the course of the census, knots were seen in small groups of two or three birds, from the vicinity of Lindbergh Field south along the bay side of the Coronado Strand to the head of San Diego Bay. Examination of the few specimens of knots in the collection of the San Diego Society of Natural History revealed one unrecorded winter-taken bird, a female, collected at Pacific Beach, San Diego, California, on February 12, 1892, by Frank Stephens.—LAURENCE M. HUEY, *San Diego Society of Natural History, Balboa Park, San Diego, California, January 5, 1938.*

Laysan Albatross on San Nicolas Island, California.—On April 5, 1909, C. B. Linton's Mexican camp cook, during his employer's temporary absence, captured an albatross on San Nicolas Island, which he cooked and ate. Mr. Linton succeeded in saving the head which remained in his possession until his collection was acquired by John E. Thayer. Linton identified the remains as those of the Short-tailed Albatross, *Diomedea albatrus*, and as such the specimen was first recorded by George Willett in Pacific Coast Avifauna No. 7 (1912, p. 17). The same bird again appeared in literature in 1917 when A. B. Howell (Pac. Coast Avif. No. 12, p. 30) quoted the record first published by Willett, while its third appearance was in 1933 when Willett again published the original instance of occurrence (Pac. Coast Avif. No. 21, p. 14) as the last known record of capture of *Diomedea albatrus* in California.

Apparently the basis of the record was originally identified by Linton and his determination was accepted without question by both of the authors involved; in fact neither Willett nor Howell mentioned having examined the specimen themselves.

Recently, while going over the Procellariiformes in the Thayer Collection, now in the Museum of Comparative Zoölogy, it was quite obvious that the specimen was not *Diomedea albatrus*, but more probably *D. immutabilis*, and as such I tentatively identified it. However, just to make sure, I sent the head to Dr. R. C. Murphy who concurs with me in its identification.

Thus it appears that when Linton's camp cook killed this bird he was not taking the last specimen of *D. albatrus* to be secured off the southern California coast, but the first specimen of the Laysan Albatross, *D. immutabilis*, from the Pacific coast north of Lower California.—JAMES L. PETERS, *Museum of Comparative Zoölogy, Cambridge, Massachusetts, December 8, 1937.*

Screech Owls and Automobiles.—These notes, taken over the period of one year of watchfulness, seem to indicate that the Screech Owl (*Otus asio*) suffers to a great degree from automobiles, at least in the Santa Cruz area of California.

Interest was awakened on December 14, 1936, when a Screech Owl was found on the Santa Cruz-Los Gatos highway near Holy City, and another was found February 22, 1937, on the Skyline Boulevard near Big Basin. On November 9, 1937, one was found on Corralitos road near Corralitos, November 12 and 13, 1937, two more were found near Pinto Lake, Watsonville, on the Green Valley and Amesti roads, respectively. Then, on January 24, 1938, one was picked up on the Casserly road near Watsonville.

During this period, and in over 10,000 miles of travel in this district, many other birds and mammals have been found in the road, but no other owls or other night-flying birds. However, a Horned Owl (*Bubo virginianus*) was narrowly missed on the night of May 9, 1937, on the Hecker Pass road, between Watsonville and Gilroy, California.—ALBERT C. HAWBECKER, *Watsonville, California, January 31, 1938.*

Red Phalarope on the Berkeley Campus, Alameda County, California.—On the stormy afternoon of October 30, 1937, a Red Phalarope (*Phalaropus fulicarius*) was noted at the southeast corner of the Botanical Gardens in Strawberry Canyon, on the upper campus, University of California, Berkeley. The bird circled above me on stiffly outstretched wings and alighted in a grassy field fifty yards distant. Bush-tits and White-crowned Sparrows near-by had voiced alarm, thinking it a hawk. The phalarope hobbled about at my feet, continually fluffing its feathers and occasionally squatting on its belly in the wet grass. Its weak and emaciated condition permitted an easy capture and it is now a skin (male, number 189) in my collection. This is the first record for the Berkeley campus.—JOE T. MARSHALL, JR., Berkeley, California, December 7, 1937.

The Groove-billed Ani of Lower California and Northwestern Mexico.—In the course of a recent collecting trip to southern Sonora, Robert Hannum and the writer took six Groove-billed Anis which, added to the two previously known specimens from the region, provide sufficient material for determination of systematic status. Previously I had stated (Trans. San Diego Soc. Nat. Hist., vol. 6, 1931, pp. 249-250) that a single specimen from Sonora was not distinguishable from a series from Central America and also that there was a possibility that the Lower California race, *Crotophaga sulcirostris pallidula*, might be based on characters due, in part at least, to post-mortem color changes.

The new Sonora material has been compared carefully with a series of eight *pallidula*, borrowed from the Museum of Comparative Zoology which were collected by Frazar fifty years ago and also with a series of twenty-seven specimens from localities ranging from Costa Rica to southeastern Texas. These last I take to represent typical *sulcirostris*.

At first glance it is obvious that as a series the eight Lower California birds are browner than the eight from Sonora, but on the other hand three of the eight Lower California individuals are not distinguishable from seven from Sonora. Significantly enough, the five brownest Lower California specimens show a strong brownish tinge on the labels, whereas on the three blackest the labels retain their original whiteness. Thus it seems safe to suspect that a post-mortem brown tinge has been acquired in the half century since they were collected. Incidentally, I have several times in the past called attention to the fact that Frazar skins are not to be relied upon for true color values unless checked by other material. Whether this is due simply to age or to the preservative used by him I do not know but I suspect borax is the guilty agent.

On comparison of the combined series of sixteen northwestern skins with the twenty-seven which presumably represent *sulcirostris*, it is immediately apparent that the former are more slaty below and tend to have wider and more brassy edgings to the contour feathers. But here again there are difficulties with individual specimens. Seven of the twenty-seven *sulcirostris* fit in perfectly with the northwestern series and one of the Sonora specimens is indistinguishable from *sulcirostris*.

To summarize the systematics, it would seem that *pallidula* is a rather weakly characterized race which averages slightly more slaty ventrally and also, on an average, has more brassy (less bluish) and wider feather margins. It is almost certainly not a Cape differentiate, that is to say, it probably did not develop its decidedly tenuous characters as a result of isolation in the Cape San Lucas region.

As a sidelight on the probable manner of occurrence in Lower California, it may be permissible to quote a resident with whom I talked at Cape San Lucas several years ago: "They come with the rains [that is, about July 1] and sometimes a few stay through the year but in most years none come at all." This accords with our own limited experience in Sonora. In 1937, not one ani was seen until June 16, but immediately thereafter they became common. They were in pairs and preparing to breed when we left the country in the latter part of the month.—A. J. VAN ROSSEM, *Dickey Collections, California Institute of Technology, Pasadena, California, December 1, 1937.*

Some Notes on Waterfowl in San Bernardino and Riverside Counties, California.—The following notes were taken in the fall, winter, and spring months, from 1934 through 1937, at various ponds in the San Bernardino Valley, and at Elsinore and San Jacinto lakes. The majority of the observations were made at Lake El Casco and Fisherman's Retreat, which are situated in San Timoteo Canyon southeast of Redlands. In 1936 and 1937 trips were made to these ponds quite frequently, but not with regularity. Only those species thought to be of particular interest are included in these notes.

Gavia immer elasson. Lesser Loon. An immature with the tips of the primaries quite worn was found shot May 31, 1935, in San Timoteo Canyon; the skin was preserved. In Pratt's Sporting Goods Store in Redlands there is a fine mounted skin of an adult loon of this species. I was told that it was picked up in the spring of 1935 in a field between Beaumont and Banning in a very weak condition and died shortly afterwards.

Spatula clypeata. Shoveller. The following notes seem to indicate that this species is a migrant and perhaps winter visitant. One was seen in February, 1936, in San Timoteo Canyon, and one

September 12, 1936, at Redlands City Reservoir. Shovellers were not seen in San Timoteo Canyon when trips were made in October and December, 1936, but in January, 1937, approximately twenty-five were seen, and about this same number was noted in February and the first half of March. Shovellers were almost always seen in numbers when trips were made to Elsinore. They were noted in April, October, and November, 1935; February and March, 1936; and March, 1937, in Railroad Canyon near Elsinore, and in April at Elsinore and San Jacinto lakes. In April in 1935 and 1937, in spring migration, Shovellers were very numerous at Elsinore, probably numbering into the thousands.

Nyroca americana. Redhead. This species seems to be a regular winter visitant in San Timoteo Canyon. A few usually were seen among the wintering ducks, but flocks of thirty or forty were sometimes seen after a storm or during spring migration. Birds were noted in October, 1935; February, March, September, October, and December, 1936; and February and March, 1937.

Nyroca collaris. Ring-necked Duck. Apparently a common winter visitant in San Timoteo Canyon. Observed many times at close range with 8-power binoculars. Scaups and other species were present for comparison. Eight or more were noted on March 15, approximately thirty March 29 and three April 23, 1936. Four were seen at Redlands City Reservoir November 7, 1936. A flock varying from about fifteen to thirty-five was seen in San Timoteo Canyon December 26, 1936, January 30, February 20, and March 1, and a few March 11, 1937.

Lophodytes cucullatus. Hooded Merganser. A female was observed December 23, 24, and 25, 1934, in company with a few American Mergansers at Redlands City Reservoir. I was able to get within twenty or thirty feet of her and observed her closely for some time.

Mergus merganser americanus. American Merganser. It is possible that some of the following records may pertain to the Red-breasted Merganser, but no male Red-breasted Mergansers were seen in the periods when the mergansers were in this vicinity, and male American Mergansers were sometimes present in the flocks, although most all of the birds had female plumage. When close observation of females was possible, they proved to be American Mergansers. Also, I have skins of two American Mergansers which were found shot in San Timoteo Canyon. A female was found January 30 and a male March 12, 1937. On December 13, 1934, eleven birds arrived at Redlands City Reservoir. From this date until December 25 from three to fifteen birds were present nearly every day, and one was present December 31. Two were seen near Loma Linda on December 16. In 1937 American Mergansers were again noted in this vicinity. From one to about five were seen in San Timoteo Canyon January 30, March 1, 4, 11, and 21.

Mergus serrator. Red-breasted Merganser. A male in full plumage appeared on Redlands City Reservoir April 28, 1937, and is still present. Perhaps he is wounded. I have never seen him fly any distance. On September 17 I looked at the bird with binoculars and noticed that his plumage was greatly changed; he was in the eclipse plumage and looked quite like a female. On September 24 I was able to get very close to the bird. His head was the color of a female's and had a small crest, the brown band did not cross the breast, and the primaries and secondaries were entirely molted.—HAROLD M. HILL, Redlands, California, September 24, 1937.

Hybridization of Juncos in Captivity.—In order to verify certain conclusions drawn from a study of naturally occurring hybrid juncos, an attempt has been made to breed two distantly related types in an aviary. Since January, 1935, I have had a male Red-backed Junco (*Junco caniceps dorsalis*) in captivity in my cages in Berkeley. Mr. Lyndon L. Hargrave very kindly sent me this bird from Flagstaff, Arizona, where he trapped it. Because *dorsalis* is essentially non-migratory, a cross was attempted with the permanently resident Point Pinos Junco (*Junco oreganus pinosus*) which has a breeding season similar to that of *dorsalis*. These two races, although they never meet in nature, represent species which do.

The pair of birds was kept in an 8'x8' aviary with an average height of about 7 feet. The birds were supplied with a variety of seeds and they could obtain a small number of insects from the natural vegetation in the cage. Some insects were blown into the cage from the oak trees and grass that surrounded them. It was necessary to keep other juncos, both captive and wild, out of sight in order that the nesting pair be undisturbed. The sound of other juncos singing, although definitely noticed, did not cause trouble.

The female of the pair was a local bird that was taken early in the spring of 1935, at which time she had a brood patch. On June 13 she was placed with the male *dorsalis*, but they did not breed. The female undoubtedly was too much disturbed by her unaccustomed confinement to resume nesting at this late date.

In late May of 1936, the female laid two eggs. These she incubated, but about three days before the time for hatching, the birds removed them from the nest. The embryos were nearly fully developed, but were dead, at least when found. Immediately another nest was started on the same site, a beam

6 feet above ground, and three eggs were laid. On the evening of the eleventh day of incubation one of the eggs was partly open and the young one could be seen within. The next morning this bird was found removed from the nest and dead. Apparently it had not hatched successfully as its down was not fluffed out and the umbilicus was not perfectly closed. The other two eggs were pipped. However, they failed to hatch, and when removed several days later the young were found to have died just as development in the egg was completed. It began to appear that some deficiency or disharmony in development in these hybrids became manifest at this age.

In 1937, the first set of 2 eggs was completed by this pair on May 25, and incubation was begun. On the morning of June 6 both eggs had hatched and the young were normal in every respect. On the evening of the 7th both were removed to attempt rearing by hand. This was unsuccessful and the birds died the next day. The failure in this instance must be laid entirely to incorrect care and nutrition and not to weakness of the hybrids. Similarly, difficulty in most instances has been encountered in rearing the offspring of captive parents that were both typical *pinosus*.

The results, which as yet are rather unsatisfactory, do permit certain conclusions. These are that strikingly different juncos, when placed together in captivity by themselves, will accept one another as mates and proceed to nest as readily as will birds of like race. *Dorsalis* and *pinosus* can produce viable young. But, nothing can be said as to comparative vigor of hybrid offspring.—ALDEN H. MILLER, *Museum of Vertebrate Zoology, Berkeley, California, March 5, 1938.*

Records of Arrival of Calliope Hummingbirds.—In the January, 1938, issue of the *Condor* (p. 42) I read with interest the field note by Mr. Woods concerning an early spring migration record (March 6) for the Calliope Hummingbird (*Stellula calliope*). It struck me that this was not an especially early record for the Calliope, and on going to my records of first arrivals in Yosemite Valley I found the following:

| | | |
|----------------|----------------|----------------|
| March 2, 1924 | April 26, 1927 | April 2, 1930 |
| March 24, 1925 | March 8, 1928 | March 21, 1931 |
| March 18, 1926 | April 18, 1929 | April 7, 1932 |
| | | April 14, 1933 |

All of the above records are for a single male bird that put in his appearance on the warm alluvial fan that spreads out at the mouth of Indian Canyon. For five years the favorite perch of this first arrival was on a dead twig that stood above a clump of ceanothus bushes beside the Foley Studio. In the course of a clean-up campaign the dead wood in this ceanothus clump was trimmed away and the "first arrival" was forced to move about fifty yards to a new perching site that had escaped the campaigners. This new site became the favorite perch of the "first arrival," and here he could be found during the spring months for the next five years.

Mrs. Michael has often said that the Calliope Hummingbird does not date his arrival in Yosemite Valley by the calendar, but that his arrival is coincident with the blooming of the manzanitas. As a matter of fact, of all the summer visitants to Yosemite Valley, the Calliope Hummer is the most irregular in time of arrival.

Once the Calliope did arrive he stayed put; he did not leave the neighborhood in search of a mate. Apparently he had a rendezvous, for always a mate put in her appearance. When the courting days were over the female disappeared. The male stayed on for weeks, even months, depending on the seasonal bloom. Because a bird came early year after year to the same locality and to the very same perch, I wanted to believe that it was the same individual, but this I could never establish by evidence.

I have a suspicion that the female nested directly across the valley, a half mile away from the garden of the honeymoon. Here in a small golden-cup oak that clung to a bluff in the shadow of the south wall a nest was built in four successive years. The fact that nesting records are rare and that female Calliope Hummingbirds are seldom seen on the floor of the Yosemite in the nesting season influenced me in my suspicions.—CHARLES W. MICHAEL, *Pasadena, California, January 23, 1938.*

NOTES AND NEWS

The dates for the Thirteenth Annual Meeting of the Cooper Ornithological Club at Fresno have been set for Friday and Saturday, April 15 and 16, 1938. The sessions will be held in McLane Hall on the campus of Fresno State College. On Sunday, the 17th, there will be a field trip to the Los Baños marshes under the guidance of Mr. John Tyler. Members who wish to contribute to the scientific sessions should submit titles at once, so that details of the program can be arranged. The business meeting of the Club and the election of directors has been scheduled for 10 a.m., April 15. The business managers especially urge that proxies be returned on the forms sent from their office in order to make possible the transaction of official business. Members of both the northern and southern divisions anticipate a pleasant and profitable meeting at Fresno. The local committee, through its chairman, Professor William T. Shaw, extends a special invitation to attend.—A. H. M.

Witmer Stone's two-volume work entitled "Bird Studies at Old Cape May" stands out in our estimation as *the* contribution to American ornithology during the year 1937. It comprises a total of xiv plus 941 pages, 2 colored frontispieces, no less than 119 halftone plates, and a great number of drawings. Essentially this is an exhaustive record of field observation by many bird students in a given area and for a given period, mainly 1920 to 1930. But also, it is a chronicle of practically everything known from the beginning of history concerning the bird life of coastal New Jersey, indeed of that entire state. This work looks very definitely to be a contribution from the Delaware Valley Ornithological Club, in which organization Dr. Stone has been a moving factor ever since the date of its founding, in 1890. Over 100 of its members, present and past, have participated in the production of the book, by furnishing written accounts, censuses, drawings and photographs. These have been put together by Dr. Stone, along with the results of his own concentrated field studies, in masterly fashion—a lasting demonstration of what genuine cooperation can do. Emphasis is placed upon bird behavior, habitat relations, and the nature of human influences upon bird communities. A quotation here (from page 37) will show why Californians, for example, may benefit in some practical way from consulting this work. "It may still be possible for the summer resorts along the coast to establish themselves as wildlife sanctuaries. Following the lead of the Audubon Association the borough of Cape May Point has forbidden gunning within its limits and the residents of Brigantine have

made a sanctuary of that island. It is nothing less than a calamity that a portion of Seven Mile Beach and the area between Cape May and the Point were not secured when their purchase was easily possible and dedicated to the preservation of Nature; but there is still opportunity to bring common sense into the mosquito draining work and to instill a proper appreciation of wildlife preservation into the popular mind. With the enormous increase in the ranks of nature-lovers, today, there is no better way to exploit our seaside resorts than by advertising their wealth of wild birds and wild flowers, and if such a plan were followed here it would attract thousands of visitors of the most desirable character and redound to the reputation and financial benefit of Cape May." We understand that copies of this publication can be had from the Academy of Natural Sciences, Philadelphia, at bare cost of printing, namely \$6.50, including charges for packing and forwarding.—J. G.

A mimeographed bulletin entitled "California Bird News" comes to our desk from the Division of Wildlife Research of the Bureau of Biological Survey. It is clear from the statement of cooperation with state agricultural agencies which it contains and from the tenor of its contents that the main purpose is to make known the activities of governmental agencies in the "control" of birds. The bulletin must be successful in attaining this objective. Especially, does it endeavor to show the need for "control." In the issue of October, 1937 (vol. 2, no. 4), attention is called to the requirement that Agricultural Commissioners report the number of birds killed in control operations. "The Bureau wants to know what species are being controlled, and the number of each species killed." We submit that it would be fitting for "California Bird News," in keeping with its title, to present a summation of such reports and also the number killed by the Biological Survey itself. Not only should the group which the "News" reaches be interested in the figures but also those people who are not in sympathy with "control."—A. H. M.

Memoir No. VIII of the Nuttall Ornithological Club, issued in December, 1937, is devoted to "an account" of that organization from the year of its founding, 1873, until the death of William Brewster, its first and continuing president, in 1919. The author, one of the Club's earliest members, is Charles F. Batchelder, himself also a long-time officer, serving as Treasurer for no less than fifty consecutive years! Of all the now many ornithological "clubs" in America, the N.O.C. was not only the first but undoubtedly the most

potent in its influence upon the growth of bird-study throughout the country. Not only have eminent men been members of that group, at least in their formative years, but important subsequent enterprises stemmed from it. Batchelder does not say as much, but the reader cannot escape this conclusion after reading his accurately written historical account. This includes biographies and early portraits of many of the men we know through our literature, that of the West as well as elsewhere; for example (besides Brewster), Henry W. Henshaw, J. A. Allen, Frank Bolles, John Murdoch, Outram Bangs, John E. Thayer, Bradford Torrey, Charles W. Townsend, Ralph Hoffmann; and, more recently, A. C. Bent, Glover M. Allen, John C. Phillips, Francis H. Allen, James L. Peters, and numerous others. Thus we westerners have here a repository of biographical data bearing here and there importantly upon our own special field of interest. Incidentally, we are afforded another fine demonstration of "New England" literary skill. Mostly, writers elsewhere seem too much in a hurry to heed the literary proprieties. Mr. Batchelder dedicates his book "To those friends of mine who appear in these pages but who will not read them."—J. G.

Two references to the systematics of birds of western North America have come to our attention that might escape the notice of students in this field. Both relate to flycatchers. These items are found in John T. Zimmer's "Studies of Peruvian Birds" that appear in the American Museum Novitates. In number 962 of the Novitates, of date November 18, 1937, opinion is expressed (pp. 12-13) that the western race (*hespericola*) of the Eastern Kingbird (*Tyrannus tyrannus*), described by Oberholser from the Warner Valley of Oregon, appears not to warrant separation. Although no final conclusion is voiced, serious question is raised concerning the recognition of this subspecies. In number 963 of the same series, and of same date, more extended consideration is given (pp. 1-6) to the nomenclature of the Sulphur-bellied Flycatcher of southeastern Arizona. It is claimed that the type of *Myiodynastes luteiventris vicinior* Cory, taken in Peru, is a migrant of the Arizona form, so that on the basis of priority this name replaces *M. l. swarthi* van Rossem for the race occurring in the United States.—A. H. M.

MINUTES OF COOPER CLUB MEETINGS

NORTHERN DIVISION

NOVEMBER.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, November 18, 1937, at 8:00 p. m., in Room 2503 Life Sciences Building, Berkeley, with President Kin-

sey in the chair and about sixty members and guests present. Minutes of the Northern Division for October were read and approved. Minutes of the Southern Division were read. Names proposed for membership were: Grace Tompkins Sargent (Mrs. M. C. Sargent), Scripps Institution of Oceanography, La Jolla, California, and Jane Nold, 83 Castro Street, San Leandro, California, both by E. L. Sumner through the Western Bird Banding Association.

Mr. Test read a letter from Major Allan Brooks dealing with the question of a possible closed season on duck hunting and suggesting other methods for waterfowl restoration. A bulletin issued by the Audubon Societies, entitled "Thirst on the Land," by William Vogt, was reviewed by Mr. Test. This pamphlet decries present wasteful drainage practices and suggests better methods for use of the land and water. After prolonged discussion of a number of the problems involved, it was moved and carried that the Northern Division also go on record as favoring a three-year closed season on all duck hunting.

Mr. Howard Twining spoke on "The Natural History of the Sierra Nevada Rosy Finch," the results of two summers of observation in Virginia Canyon, north of Tuolumne Meadows. Daily behavior, foraging habits, influence of predators, and a full account of breeding activities, nesting and development of the young, were presented in a pattern which might well be applied to the study of other bird species. Of the possible factors suggested to explain the restriction of this species to high altitudes, the most potent would seem to be safety of breeding places in summer, winter competition of other species at lower levels, and the bountiful food supply exposed on bare rock surfaces by slipping snow. Lantern slides fully illustrated the detailed observations.

Adjourned.—FRANCES CARTER, Recording Secretary.

DECEMBER.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, December 23, 1937, at 8:00 p. m., in Room 2503 Life Sciences Building, Berkeley, with President Kinsey in the chair and twenty-five members and guests present. Minutes of the Northern Division for November were read and approved. Minutes of the Southern Division were read. An application for membership was read from Ross Hardy, 429 North Second East Street, Price, Utah, endorsed by William H. Behle.

Mr. Emlen, who is seeking an ecological explanation of the winter distribution of the crow in California, asked for observations on the presence or absence of the species and left questionnaire forms to be filled out by members having such information. Mr. Pease read a set of resolutions voicing the objections of the

Cooper Club to possible granting by the Berkeley City Council of a petition to allow shooting of ducks on bay waters adjacent to the Aquatic Park and Game Refuge, within the three-mile limit covered by the present ordinance against discharge of firearms within the city limits. It was unanimously voted that the resolutions be adopted and copies sent to City Manager Hollis R. Thompson. President Kinsey appointed as a committee to nominate officers of the club for the coming year: Alden H. Miller, chairman, H. W. Carriger and Robert T. Orr.

Many members contributed to the evening's discussion of field notes. Mr. Grinnell, who had recently returned from an extended trip through the southern California deserts, mentioned some of the disadvantages of rapid travel by automobile but brought out one distinct recompense, the quick succession and sharp contrast of many different types of country and the glimpses afforded of the occupants peculiar to these different habitats. As an example, he cited the distribution of the *Phainopepla* and its relation to the principal food supply, mistletoe berries, whether in oak, mesquite or cottonwood trees. Mr. Bond reported on the status of the raptorial birds of Lava Beds National Monument, stressing the effect of severe winter weather early in 1937 in greatly reducing the numbers of hawks and owls by cutting off the food supply that consisted of field mice. Shooting by the Biological Survey and by farmers also had its effect. Mr. Dyer made the valuable suggestion that where land is occupied by tenant farmers, the terms of their leases might be made to include protection of hawks and owls. Mr. Emlen reported a good season for ducks and geese in the Sacramento Valley, both showing an increase in numbers over former years and benefiting greatly by the high water throughout the valley.

Mr. Covell announced that the new list of the waterfowl of Lake Merritt, Oakland, published jointly by the Metropolitan Oakland Committee and the Lake Merritt Breakfast Club, was ready for distribution. A member who is in correspondence with a bird student in Wyoming reported the occurrence of the European Starling on the University of Wyoming campus, at Laramie. This record upsets the theory that the species would not extend its range west of the one-hundredth meridian and leads one to wonder whether the Pacific coast will long remain free of the starling problem. Mr. Dyer described the behavior of an injured Black-bellied Plover entrusted to his care by Mr. Kinsey. This bird's wing, which had been broken at the wrist joint, was taped up by Dr. Reynolds and will probably heal in a fairly normal position.

Adjourned.—FRANCES CARTER, *Recording Secretary*.

SOUTHERN DIVISION

NOVEMBER.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held on Sunday, November 21, 1937, at 2 p. m., at the aviaries of W. J. Sheffler, 535 New York St., Hawthorne, with President Little in the chair and about sixty members and guests present. Minutes of the Southern Division for October were read and approved. As there was no other business to transact, the business meeting was adjourned and the members were given plenty of time to inspect the wonderful collection of birds, both foreign and native, that Mr. Sheffler has in the cages.

Adjourned.—SIDNEY B. PEYTON, *Secretary*.

DECEMBER.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum, Exposition Park, Los Angeles, on Tuesday, December 28, 1937, at 8:00 p. m., with President Little in the chair and about eighty members and guests present. Minutes of the Southern Division for November were read and approved. Minutes of the Northern Division for October and November were read by title only. Mr. Michener told of a Desert Sparrow Hawk that had been trapped in Pasadena that day. It had first been trapped early in the summer and released at Beaumont; it was trapped again two weeks ago and released at Etiwanda. This time it was to be released at Oceanside. Mr. Glassell told of a strange bird that had been reported from near Catalina Island, described as a cross between a pheasant and a gull, with a bright red bill. Mr. Abbott of San Diego, told of a similar bird seen near San Diego, except that it was described as a cross between a rooster and a gull. It was evident from the accounts that the birds were Red-billed Tropic Birds. President Little appointed Dr. Loye Miller, George Willett and Howard Robertson on the committee to nominate officers for the Southern Division for the coming year.

J. R. Pemberton, the speaker of the evening, presented motion pictures taken on two different trips down the west coast of Lower California to Guadalupe Island, Magdalena Bay, and around into the Gulf of California.

These interesting pictures showed the herd of elephant seals on Guadalupe Island and the colonies of sea birds occurring on the different islands along the coast of Lower California. The films of the trip into the Gulf showed the nesting and courtship antics of three species of boobies, the nesting ground of the Heermann Gull, the natives of Tiburon Island and the home of the fish-eating bats. Mr. Pemberton stated that he was leaving about January 15 on another trip down the west coast of Mexico and Central America, and promised the Club a showing of the films taken on this trip.

Adjourned.—SIDNEY B. PEYTON, *Secretary*.

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